Lab 7 Report

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A. Objectives

1. Overview

1.1. Objectives:

Our goal in this project is to create a "Soundtrack to My Life" device so users can feel connected to music by their motion. Many people enjoy listening to music on-the-go ever since the advent of portable MP3 player and headphone technology. We want to extend this trending integration of music-listening into daily activities in a more personal way. By creating a system which can observe a user's movements and tailor a song to them, we believe we can create a truly unique musical experience which any music enthusiast can enjoy.

1.2. Roles and Responsibilities: Our responsibilities as inventors of this soundtrack device involve 1) devising its features and function, 2) creating its hardware and software components, and 3) ensuring the product meets our own arbitrary standards.

1.3. Interactions with Existing Systems: At this moment, we have no plans to interface more than one microcontroller, but if the CPU time for driving sound, graphics, and accelerometer measurements proves too much for one TM4C123GXL, we may use UART to divide up the labor among 2-3 processors.

2. Function Description

2.1. Functionality: Our system will take MIDI files of piano music and play them for a user through headphones while tracking the user's footsteps and using their walking speed to dynamically set the music's tempo. The device will allow the user several song choices, which they can select using switch buttons and a graphical display. The device will also be wearable as an armband to allow it to be taken on runs/walks.

2.4. Performance: There are several different components of this device which must be tested separately before being combined and tested in an integrated manner.

Sound: We will measure the performance of our sound drivers by checking our different possible note outputs and their frequencies using an oscilloscope and measuring the note accuracy. We will also compare the music our DAC plays to the sound of the original MIDI file when played through Ableton (a Digital Audio Workstation which plays MIDI files). By comparing our music at varying tempos to the sound of the MIDI file via Ableton, we can qualitatively assess the sound driver's success.

Accelerometer: We will test the function of the accelerometer using an array dump profile and a series of planned acceleration events--checking for expected values against our list of acceleration events. To test our step-rate code, we'll print step rate to our ST7735 LCD and check the accuracy while walking/running/jogging.

Graphics/Switch Interface: We can do simple graphical tests by displaying our UI and navigating through it with our switches.

Integration Testing: We'll test the product as a whole with walk/run/jog tests for each song.

2.5. Usability: The primary user interface we will provide to our user is an LCD screen and switches to navigate through the menu and make selections. This will include a Play/Pause button, a Rewind button, menu-navigation buttons, and a Select button. We will also include a headphone interface where a user may plug in whatever eighth-inch audio interface they want.

3. Deliverables

3.1. Reports: We will write reports for Lab 7 and Lab 11.

3.2. Outcomes: Our outcomes are the deliverables for labs 7 and 11 listed below.

I. Lab 7 Deliverables (exact components of the lab report)

A) Objectives

1-page requirements document

B) Hardware Design

Regular circuit diagram (SCH file)

PCB layout and three printouts (top, bottom and combined)

C) Software Design

Include the requirements document (Preparation a)

D) Measurement Data

Give the estimated current (Procedure d)

Give the estimated cost (Procedure e)

II. Lab 11 Deliverables (exact components of the lab report)

A) Preparation (20) shown to TA before lab starts

High level application for the system, graded on completeness rather than style (10)

Complete BOM and having all parts (5)

2-page requirements document (5)

B) Checkout (30)

Project demonstration, quality of design (30)

Description of how the system was tested (5)

C) Software Quality (30)

Modularity and organization (10)

Readability (10)

Functionality (10)

D) Report (20)

Testing procedure and testing data (10)

YouTube video (10)

4. Planning

4.1. Modularization: In considering how best to schedule and divide the labor for our final project, it is useful to approach the project by modularizing tasks. The task modules will be as follows:

I. Prototype Testing

A) Accelerometer measurement tests (3/26- 3/31)

B) DAC output tests (3/26- 3/31)

C) ESP communication tests (3/26- 3/31)

D) File system/SD card test (3/26- 3/31)

E) File system/DAC interface test (4/1- 4/8)

F) DAC/accelerometer interface test (4/1- 4/8)

G) System integration test (4/8-4/11)

II. PCB Assembly/Testing

A) PCB soldering (4/11-4/13)

B) PCB accelerometer measurement tests (4/13- 4/16)

C) PCB DAC output tests (4/13- 4/16)

D) PCB ESP communication tests (4/13- 4/16)

E) PCB File system/SD card test (4/13- 4/16)

F) PCB File system/DAC interface test (4/16- 4/23)

G) PCB DAC/accelerometer interface test (4/16- 4/23)

H) System integration test (4/24- 4/30)

B. Hardware Design

- **See attached sch and pcb**

C. Software Design

- Read above Requirement DOcs

D. Measurement Data

a. Give estimated current: 254 mA

b. Give estimated cost: $106.04 for all parts, $12.63 paid

E. Analysis and Discussion

(None)