Lab 8 Software Drivers for an Embedded System

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1. Overview

1.1. Objectives

This project's purpose is to design our hardware drivers that we will be using in our final lab

1.2. Roles and Responsibilities

As a group, we will design project we will later implement in the final lab. We will consider which input/output devices need to interact with each other and design device drivers that will facilitate that in our later lab. The clients for the project are the graders; the TAs and Professor McDermott.

1.3. Interactions with Existing Systems

We are not connecting to any other existing systems.

2. Function Description

2.1. Functionality

We are going to implement a home security system. When a person approaches the door, the motion detector senses it and activates the monitor, which allows the house owner see the live video inside the house. A microphone is used for communication across the door (imagine the monitor is somewhere far from the door). There will a button for the bell, and a keypad for passcode input to unlock the door. Door lock and unlock will be demonstrated using a servo. If the person cannot input the correct code in three attempts, the system will sound an alarm and send an sms message to the owner informing the intrusion. The user can change the passcode of the system by holding the "*" key down for three seconds.

Ideally there is supposed to be a speaker and a microphone both the outside and inside, but for demonstration purpose we will only use one set.

The underscored part is possibly going to be dropped from our final design.

2.2. Performance

The system will have to have low latency for the I/O devices to feel responsive to the user.

The audio of the system will ideally have an SNR close to that of our previous audio lab (49.3 dB)

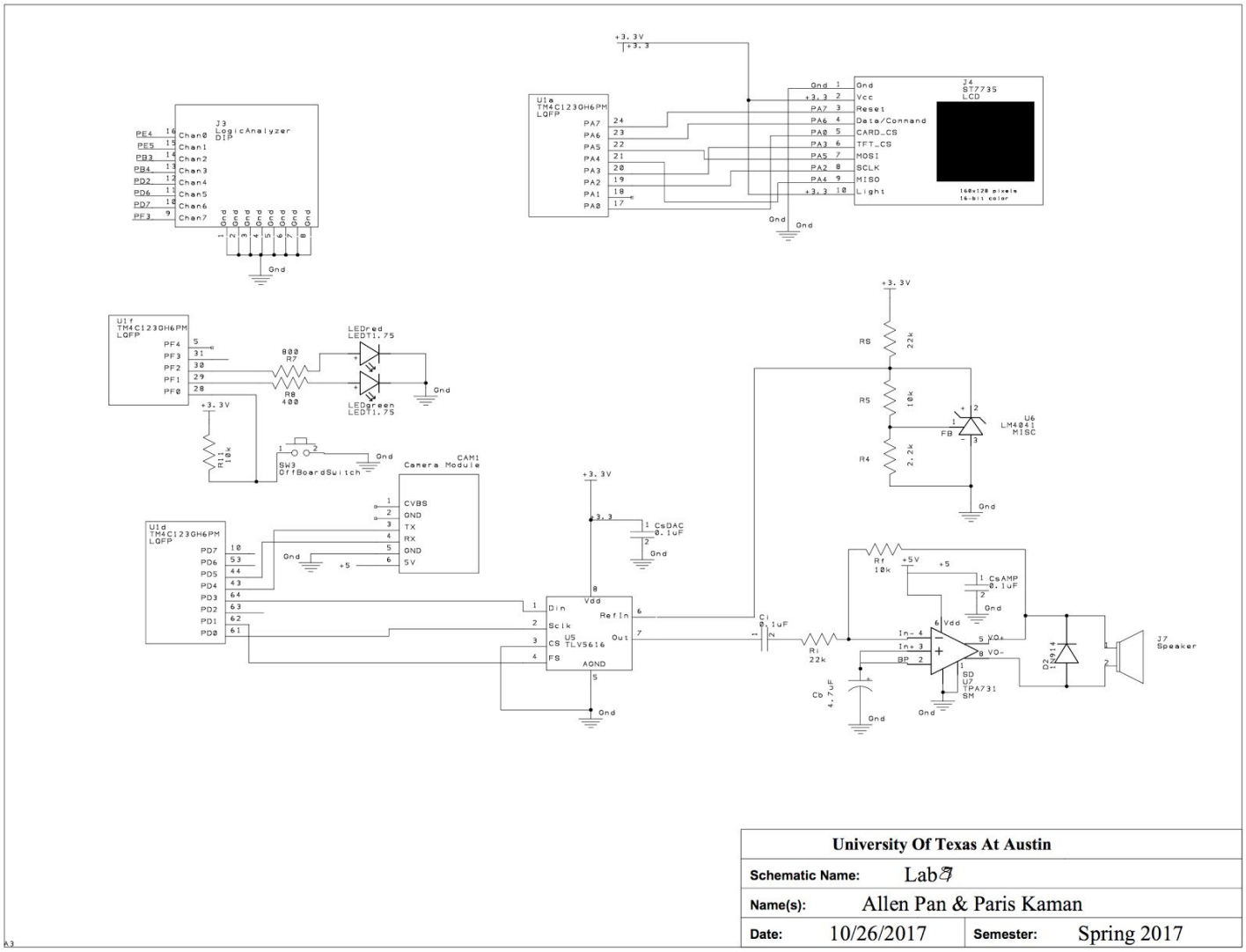
2.3. Usability

The system will likely have a 12-button keypad, a button, a motion detector, a camera, a microphone as input, and have a speaker and 2 LCDs as output. The 12-button keypad and button are the only input the user will interact with directly while the other three will provide input on their own if certain conditions are met.

The motion detection function within the camera module is possibly going to be interfaced and controlled by Arduino.

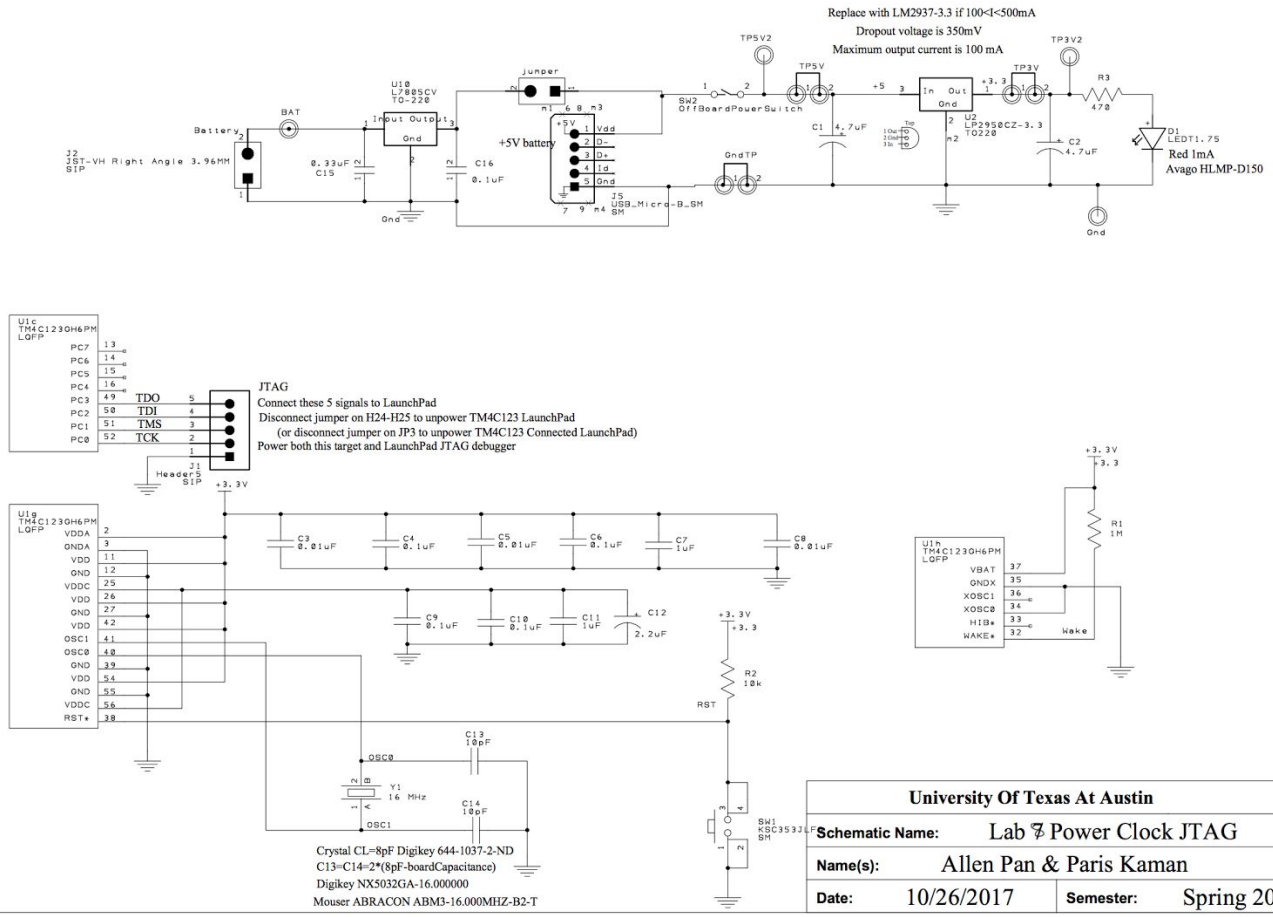
3. Deliverables

3.1 Hardware Design



Battery external to PCB

http://users.ece.utexas.edu/~valvano/HowToDesignEnclosureMakerspace.htm
This PCB will go into a Lab9Box, WoodBox and WoodBox2



Crystal CL=8pF Digikey 644-1037-2-ND
C13=C14=2*(8pF-boardCapacitance)
Digikey NX5032GA-16.000000
Mouser ABRACON ABM3-16.000MHZ-B2-T

University Of Texas At Austin			
Schematic Name:	Lab 7 Power Clock JTAG		
Name(s):	Allen Pan & Paris Kaman		
Date:	10/26/2017	**Semester:**	Spring 2017

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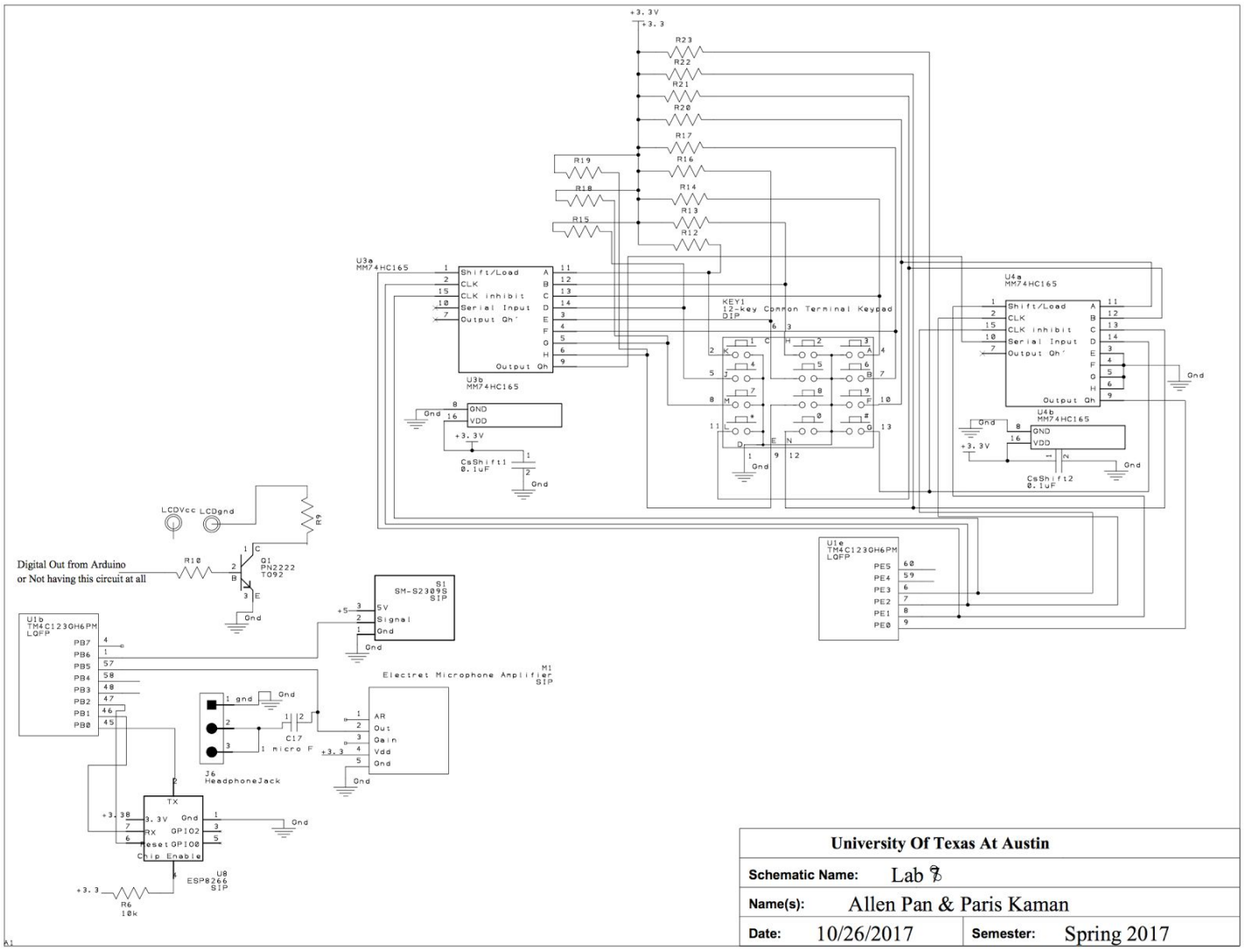

3.2 Software

Modules:

ST7735:

LCD that reflects the user input.

Speaker:

Output 1. The alarm and other system sound accompanying input and output, 2. the voice collected by microphone.

There are two channels, currently named melody and harmony (will be changed), to reflect the two output sounds.

Servo:

Rotates the servo to simulate door lock and unlock.

Currently using pins with different voltage level. Will use one pin only and use a button to control.

Keypad:

12 keys for user input. Use shift register to realize parallel input.
So far this module works to the extent that it recognizes key press. Will use timer interrupt to periodically get the input.

Button:

One button for the door bell. Use a timer for debounce.

Microphone:

Collects the voice and use ADC to convert it to digital values.
ADC sample rate is 44100 Hz.

MotionDetect:

Use the motion detector in the camera module to detect motion, which controls the monitor.
Currently this module does not work with TM4C for some mysterious reason. We will try to hopefully work it out. If not, we will use the Arduino Uno to get the motion status and control the Monitor.

Monitor:

This module likely going to be removed.
If we successfully figure out the camera using TM4C, then will directly control the video signal with the camera module (in MotionDetect)
If not, we will use Arduino, then we use one pin from the Arduino to control the monitor.
In both case, this module is not required.

Wifi:

This module is not implemented. Will only be implemented if we have time in lab 11.

Serial:

UART0, communicates with the USB port for debug purpose.

DAC:

Used internally by Speaker.

Timer:

All periodic timers we will use in this project.

3.3 Measurement Data

The value output from ADC is around 1600 when no evident audio input exists (only noise), and fluctuate around ±300 when there is an evident voice input. When connecting the output from microphone directly to the audio jack, the sound is fairly clear. Haven't tried to output the sampled data to the speaker.