

CPRE 388 Embedded Android Labs

May15-20

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Problem Statement:

Current CPRE 388 labs consisted of all android labs and no embedded component to them.

Solution:

Create three labs that utilize external hardware to add an embedded component to the class. Two labs utilize an Arduino board and the third uses an IP camera.

Functional Requirements:

Overall:

- Create Working Labs
- Labs must help students to learn concepts
- The labs need to utilize the Nexus 7 tablets and some external hardware

Morse Code Lab:

- Be able to accept a string input
- Convert the String into morse code
- Communicate the morse code of the string input

SpyCam Lab:

- User is able to stream video to tablet
- Camera movement can be controlled from tablet
- Be able to implement a variety of UI components

SketchPad Lab (Two parts):

- LED board displays the results of input
- User has the ability to vary the color of the displayed picture
- User has the ability to create different picture

Non-Functional Requirements:

Overall labs are:

- interesting and exciting to students
- relatable to real world applications
- not hard to set-up
- about 2-4 hours (on average) to complete

Keep each lab station under \$150



Technical Details

Morse Code Lab:

This lab utilizes the Nexus 7 tablet in conjunction with the Arduino Mega ADK. The tablet is programmed using java with the graphical layout being controlled by XML. The Arduino is programmed using the Arduino IDE which uses the C or C++ programming language.

Lab Station:

Each lab station needs Android Studio and the Arduino IDE. It also needs a driver for each tablet and two libraries for the Arduino to communicate with the LED board.

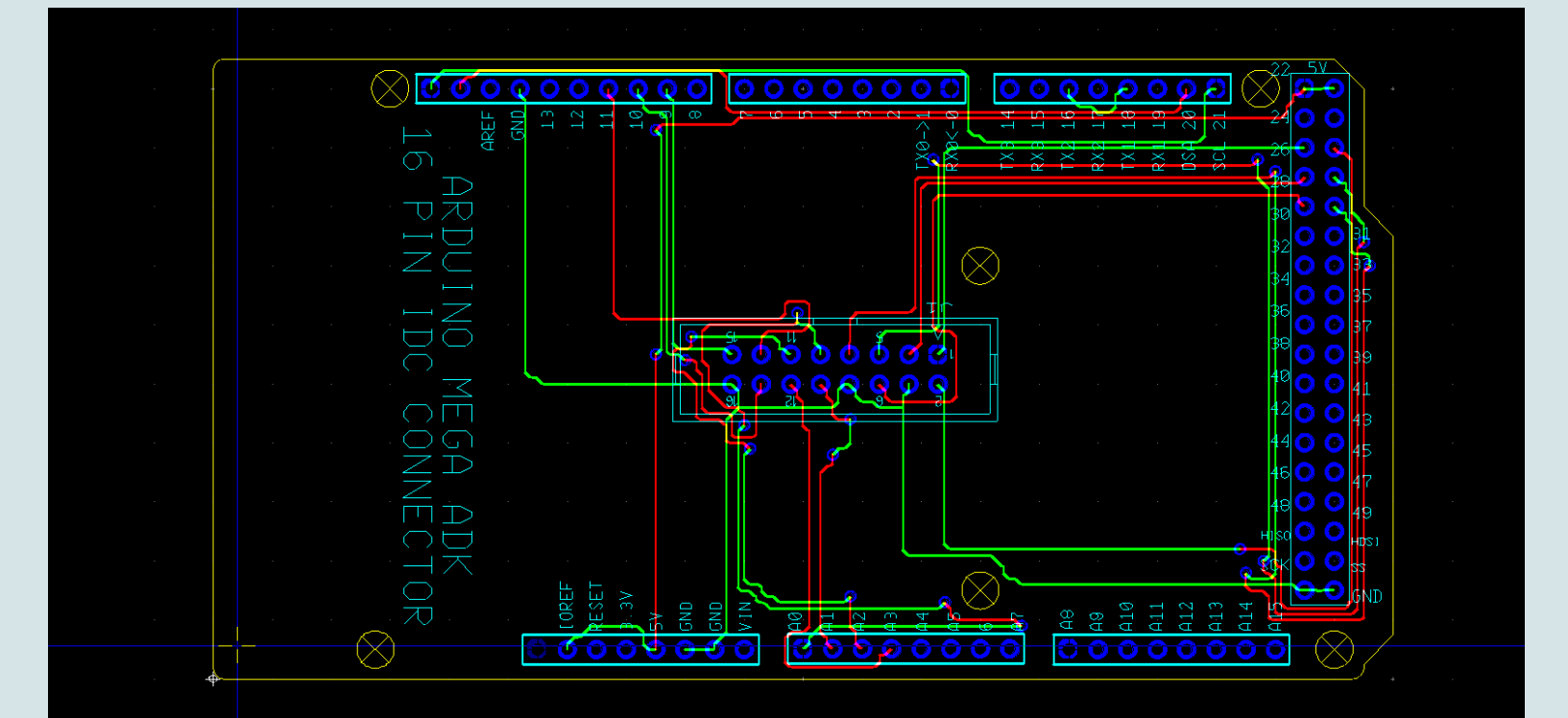
To aide in the setup of each lab station a Arduino shield was developed to connect the 16pin ribbon cable from the LED board to the Arduino Mega ADK

SketchPad Lab Part I & Part II:

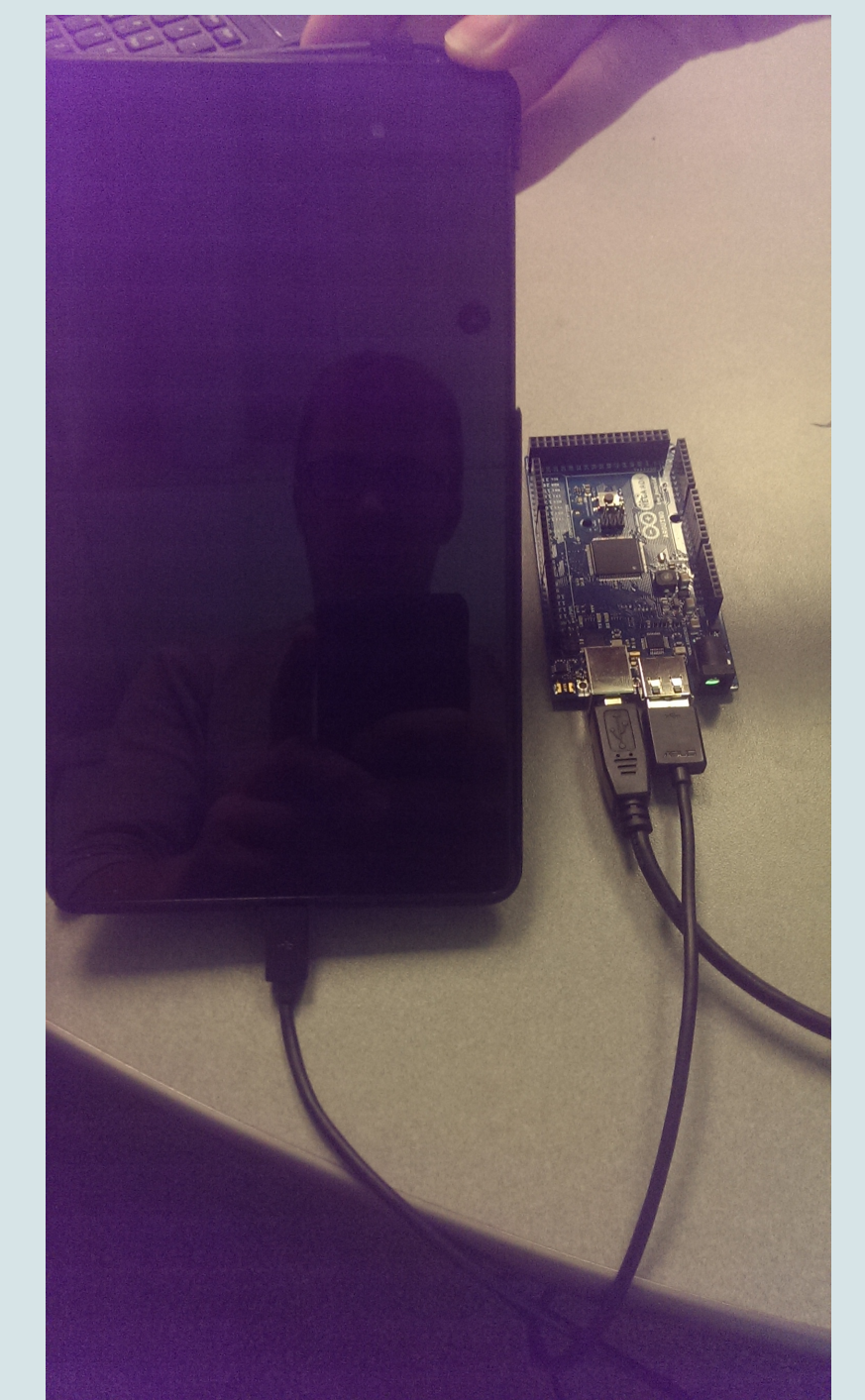
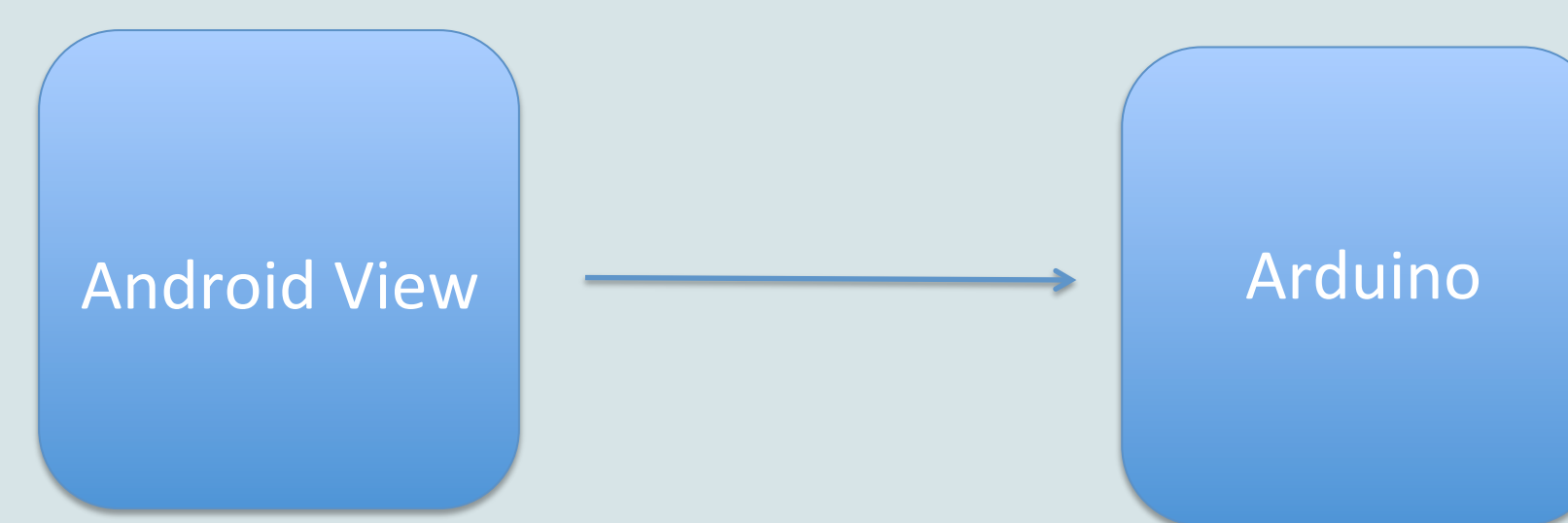
The SketchPad uses the Nexus 7 tablet, the Arduino Mega ADK and a 32x32 LED board. The tablet is programmed in Java with the application layout controlled by XML. The Arduino is programmed in either C or C++ both are accepted. The LED board is a byte array that is manipulated by the Arduino code.

SpyCam Lab:

This lab uses the Nexus 7 tablet and an IP camera. The tablet is programmed using Java with the layout using XML. The IP camera is controlled by sending HTTP requests to the camera from the tablet.

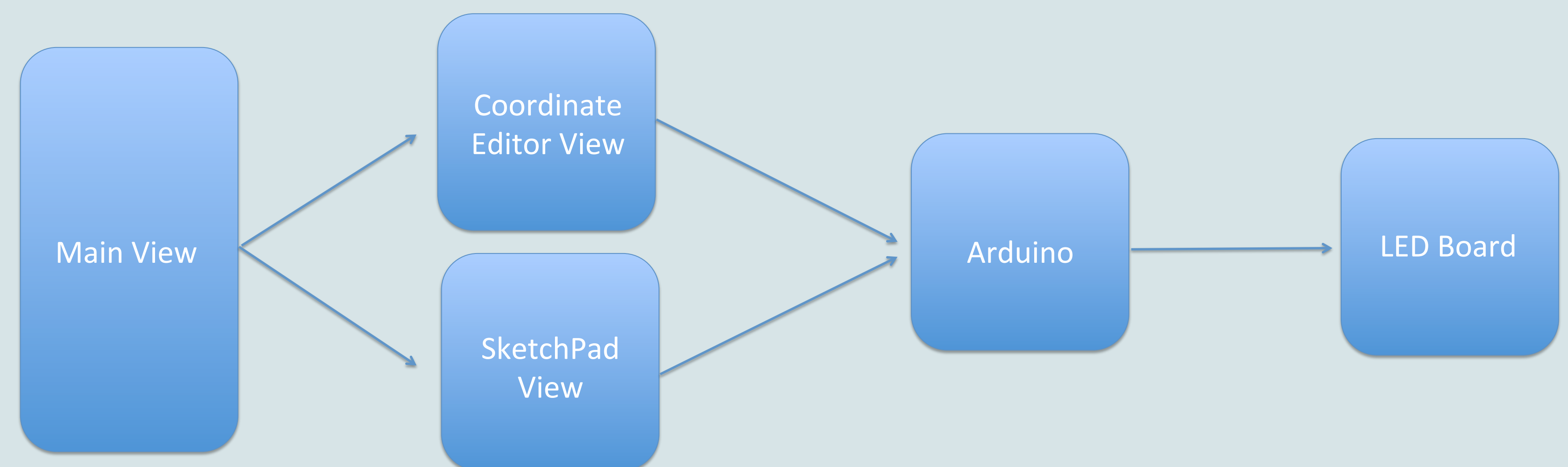


Design Approach:



Morse Code Lab:

This is the first lab that utilizes both the Nexus tablet and the Arduino. It's purpose is to provide an opportunity for the students to get their feet wet in using external hardware with the Nexus tablet.

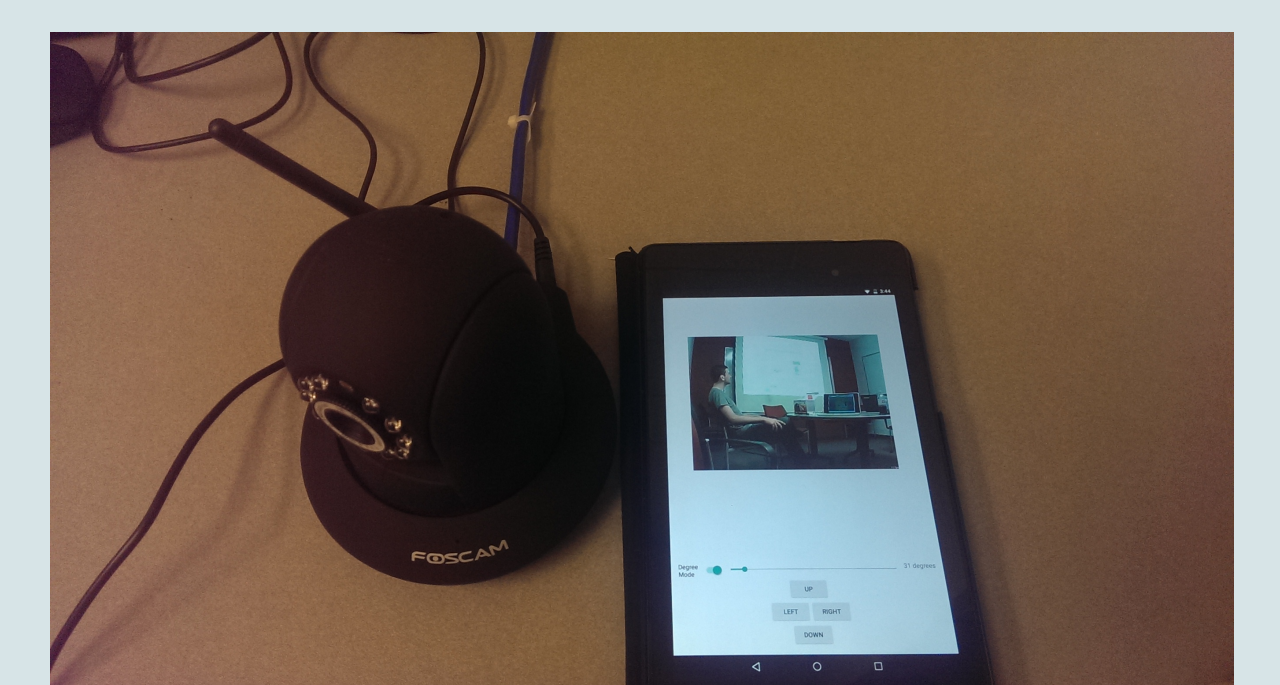
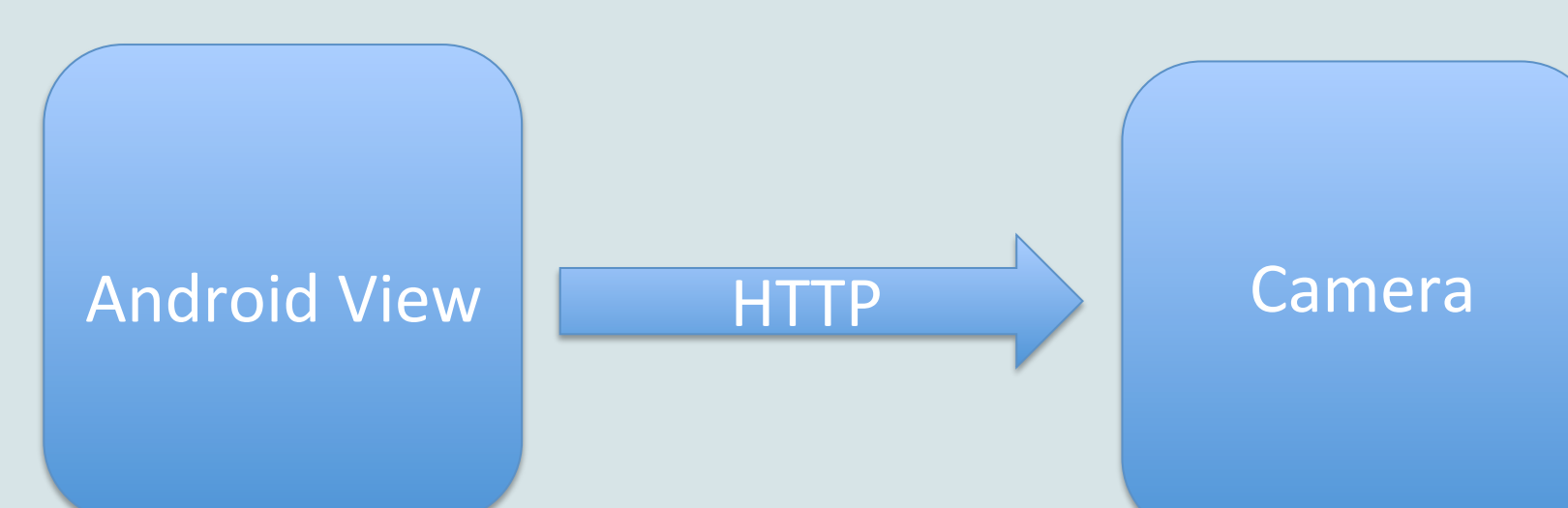


SketchPad Part I (Coordinate Editor):

This lab is the into to the SketchPad lab and helps to bridge the into that students received in Morse Code Lab into a more in depth use of the Arduino.

SketchPad Part II (SketchPad):

This is a continuation of the Sketchpad Lab which was broken into two weeks. This week builds on the first part by going further in depth on the Android side of the design and providing a more interesting interface.



Users & Uses:

The project is intended to be used by students taking CPRE 388 to help them learn not only android programming but also more about embedded systems.

Testing

To test this project, an experimental class, CPRE 276X, was setup. This class had eighteen students and met twice a week for four weeks. Each week students completed two labs, the first two weeks consisted of labs from the current CPRE 388 to get students used to android programming while the last two weeks consisted of our labs. Each student needed to fill out a feedback form for each lab to provide us with things that they enjoyed, things that were confusing, and things they thought should be changed.



SpyCam Lab:

This lab moves away from the Arduino in an attempt to show students all the different possibilities that exist with the Nexus or any Android device and external hardware.