

MODULE 9: VLC Applications

SUMMER CHALLENGE

Electrical Engineering: Smart Lighting

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Overview

- Arduinos
- Experiment
 - VLC Texting!
- Course Review
- Finalize Presentations

Arduino

- It is a microcontroller
- We can write code to tell it what to do and how to react to input
- It can communicate with other devices and peripherals
- Communication is serial
 - Serial ports: USB, Rx and Tx pins of the Arduino (Pins 0 and 1)
 - Write/read from these ports is serial (i.e., 1 bit at a time)



```
Test
void setup() {
  // put your setup code here, to run once:
  Serial.begin(9600);
}

void loop() {
  // put your main code here, to run repeatedly:

  // check for incoming serial data:
  if (Serial.available() > 0) {
    // read incoming serial data and print "Hello!"
    char inChar = Serial.read();
    Serial.println("Hello!");
  }
}
```

Experiment

- Arduino
 - Serial port and LEDs
- VLC Texting
 - Send text messages to your partner via VLC!

What did we learn here??

What we Learned

- attenuation
- EE Concepts
- full duplex vs. half duplex
- nodes, links, & networks ✓
- signal to noise ratio (SNR)
- interference
- point to point - physical layer
- handshaking (what it is & different types) ✓

Resistance Color Code ✓
 Ohms Law
 Destructive Int ✓
 AWG
 Breadboards
 Spectrum Analyzers
 Square waves from Sine
 Frequency Components

Lessons Learned

- Tinning
- Soldering
- Desoldering
- Amount of Solder
- Soldering Irons
- Sockets for IC
- PCBs
- Don't Burn board
- Silk Screen

Surface Mount vs Thru-hole

Lessons Learned

Analog Discovery Board

Current
 Voltage
 Insulators vs Conductors
 Frequency & LED Flicker
 Function Gen / Wavegen ✓
 Waveforms

Lessons Learned

Calculate Current
 Kirchhoff's Voltage Law
 RC circuit
 Capacitors ✓
 Circuit Connections
 Diodes
 Parallel vs Series Current & Voltage concepts
 RC Voltage drop vs freq ✓
 Breadboards

Lessons Learned

- > Audio transmission ✓ (with LEDs)
- > Digital Logic
- AND Gates
- Combining Analog
- Comparators
- ASCII
- Digital Transmission
- Digital vs Analog

What did we learn here????

- How does the signal travel on the cup & strings phone?
- What is the purpose of: (i) scope, (ii) spectrum analyzer, and (iii) the wave generator?
- What is Nyquist's sampling theorem?
- Define: Signal-to-noise ratio (SNR) and Ohm's law
- What is the difference between series and parallel circuits?
- What is a PCB and how are PCBs different from breadboards?
- What is the decimal equivalent of the binary value 1011001?
- What is the truth table for an AND logic gate?

Bonus: What is the maximum audio frequency recognizable to humans?

Reference Websites

- Physics Classroom: www.physicsclassroom.com
- All About Circuits: www.allaboutcircuits.com
- Khan Academy: www.khanacademy.org
- Code Academy: www.codecademy.com
- Arduino: www.arduino.cc/
- Digilent Course: www.digilentinc.com/Classroom/RealAnalog

Other Items

- Group Photo!
- Course Evaluations
- Finalize Presentations
 - Please email your slides (power point/ google slides) to prachis@bu.edu by tonight.
 - Note: 5-6 minute presentation per group and both the team members should present (~2.5 minutes each)

Finalize Presentations

- Presentation Order
 - **Team 6** (Krish and Mark) Soldering
 - **Team 1** (Ricky and Sean) Visual Light Communication
 - **Team 3** (Charlotte and Genie) LEDs
 - **Team 5** (Tucker and William) Analog signals
 - **Team 4** (Eliza and Madeline) Resistors
 - **Team 7** (Bing and Ethan) Parallel and series circuits
 - **Team 8** (Ian and Youtai) Photo-diodes
 - **Team 2** (Becca and Yutong) Resistors and Capacitors