

MODULE 9: VLC Applications

SUMMER CHALLENGE

Electrical Engineering: Smart Lighting

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Overview

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

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 Analyzer

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. Through-hole

Lessons Learned

Analog Discovery Board

Current

Voltage

Insulators vs Conductors

Frequency & LED Flicker

Function Gen / Wavegen ✓

Waveforms

Lessons Learned

Calculate Current
Kirchoff's Voltage Law

RC circuit

Capacitors ✓

Circuit Connections

Diodes

Paralleled 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 difference between a scope and spectrum analyzer?
- What is the purpose of the trigger on the oscilloscope?
- What are the definitions of amplitude, frequency, and phase?
- What is Ohms law?
- What is the difference between series and parallel circuits?
- What is a PCB and how are PCBs different from breadboards?
- What happens in the frequency domain when you clip a sine wave?
- What is the decimal equivalent of the binary value 1011001?
- What is the truth table for an AND logic gate?

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

Arduino

- **Microprocessor vs. Microcontroller**
 - Microprocessor: Takes data input, *processes*, and outputs new data
 - Microcontroller: Interacts with, or *controls*, hardware
- **Embedded Software**
 - Code - or instruction set - that runs on a microcontroller
 - Defines what the microcontroller does and how it reacts to input
- **Arduino**
 - Platform that makes embedded systems more accessible
 - Hardware is a development board containing a microcontroller and other peripherals
 - Software is simplified for ease of use and fast implementation

Serial Communication

- Process of sending data 1 bit at a time
- Serial Port
 - General purpose interface for communicating between devices
 - Typically viewed as an RS-232 connection
- Arduino Serial Port
 - Arduino uses the USB as a serial connection
 - Before running: Used to upload code to the Arduino
 - After running: Used to send data between the Arduino and monitor
 - Additional serial port: Rx and Tx pins of the Arduino (Pins 0 and 1) can be used to communicate with other serial devices!



Experiment

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



```
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!");
  }
}
```


Other Items

- Group Photo!
- Course Evaluations
- Finalize Presentations