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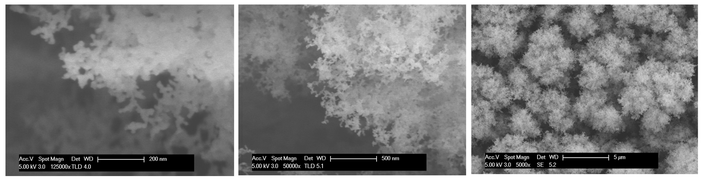
ABSTRACT

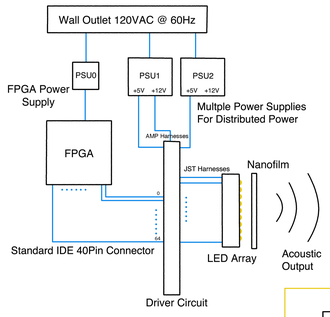
The nanostructured film recently produced by David Weld's research group has been observed to possess photoacoustic properties. When exposed to a light source of a given frequency and phase, the film responds by emitting sound with matching frequency and phase. Due to the recent discovery, no test equipments have been developed to explore the film characteristics.

This project attempts to provide a system that will allow users to manipulate the photoacoustic films, providing a framework for thorough testing of the film's properties. The use of the device will help researchers explore the potential uses of the film such as sound and light applications.

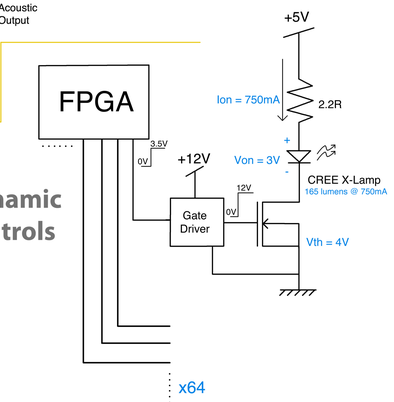


Photograph Courtesy of Weld Research Group. Photo of Nanofilm Particles.

SYSTEM OVERVIEW



The testing apparatus developed in this project allows for the control of an LED array that acts as the light source for the photoacoustic film.



The array acts as a dynamic phased array that controls the shape of the film's output beam.

OPERATION

›› The LED array acts as a dynamic phased array that controls the shape of the nano-film's acoustic output. Through a PC interface, the user is able to adjust the frequency, duty cycle, and phase of the PWM signal.

›› The FPGA uses these user inputs to generate control signals to each LED drivers. The signals applied to the gate will be PWM square waves.

›› From the output of the FPGA, the LEDs are switched on and off using a MOSFET as a switch. The gate driver provides the required Vgs to provide a 750mA drain current. At 750mA, the high-powered LEDs produce 165 lumens. The acoutsic output of the nanofilm is proportional to the lumenous intensity of the LED.

›› Current deposition techniques limits the size of the nanofilms.

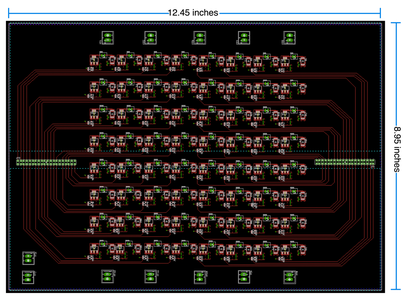
viztic

Turning light into sound.

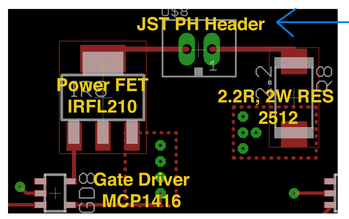
Dynamic Phased Array with High-Powered LEDs.

Carl **Felten** | Daeseong **Kim** | Andrew **Williams**

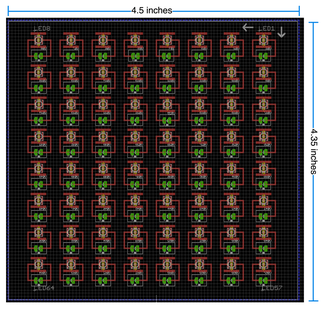
PCB LAYOUT



Zoomed in Driver Circuitry



The JST PH Headers will be connected by harnesses.



Zoomed in LED Circuity

HARDWARE

POWER SUPPLY

›› Logisys 480W 240-Pin Dual Fan 20+4 ATX PS480D2: Supplies required current to drive LED array. Two power supplies are used provide ~50 A to the array.

FPGA

›› Altera DE0 Board: 50MHz clock speed and 72 I/O pins allows each indvidiual LED in the array to be frequency and phase-controlled.

TRANSISTOR GATE DRIVER

›› MCP1416: Helps achieve the proper gate-source voltage from the FPGA to the transistor. The gate driver is able to follow phase change in the input signal as well as charge any transistor gate capacitances quickly when switching at a high frequency.

TRANSISTOR - MOSFET

›› IRFL210n: Supplies the necessary current to each LED to produce the desired luminous intensity. Each transistor is rated for 960mA.

HIGH-POWERED LED

›› CREE X-Lamp XPEWHT-L1-0000-00AE7CT-ND: Provides 165 lumens at 750mA.

FEATURES

›› Individually phase, frequency, and duty cycle controlled LEDs in an 8x8 array.

›› Simplicity and portability in design for a wide rage of research and sound applications.

›› Easily replace parts for future design.

›› Capabable of handling high-speed switching.

Acknowledgements

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Avanti Circuit Boards
Inogen