Turning Images into Sounds using Inverse Fourier Transforms

Project Design Document

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Contents

[1. Introduction 3](#_Toc402433840)

[a. Purpose 3](#_Toc402433841)

[b. Scope 3](#_Toc402433842)

[c. Definitions and Acronyms 3](#_Toc402433843)

[2. System Overview 3](#_Toc402433844)

[3. System Architecture 3](#_Toc402433845)

[a. Architectural Design 3](#_Toc402433846)

[b. Design Rationale 3](#_Toc402433847)

[4. Human Interface Design 3](#_Toc402433848)

[a. Overview of User Interface 3](#_Toc402433849)

[b. Screen Images 3](#_Toc402433850)

# Introduction

## Purpose

To input an arbitrary image and process it into a sound wave. This is related to processes done in spectroscopy and by radio telescopes. Musicians have also used this idea to make music out of images.

## Scope

This software aims to extract the pixel data of an arbitrary image and to convert that image into sound through Inverse Fast Fourier Transforms. The output is a DAQ speaker that processes a voltage measurement and outputs sound.

## Definitions and Acronyms

LV: LabView 2014 32-bit

FFT: Fast Fourier Transform

IFFT: Inverse Fast Fourier Transform

DAQ: The DAQ used in this program is a National Instruments USB 6341

RGB: Red/Green/Blue, refers to color data produced by the reading of a JPEG file.

# System Overview

For any signal, the Fourier Transform of the signal tells you the strength of each individual frequency needed to make up that signal. An image is another type of signal and a 2-D Fourier Transform can be taken of the image. This is used in image processing to blur and compress images. Here we will be focusing on taking a 2-D Fourier Transform of an image and then reversing the transform to turn the single into an audio signal.

<http://homepages.inf.ed.ac.uk/rbf/HIPR2/fourier.htm>

<http://www.askamathematician.com/2012/09/q-what-is-a-fourier-transform-what-is-it-used-for/>

<http://stackoverflow.com/questions/13549186/how-to-plot-a-2d-fft-in-matlab>

# System Architecture

## Architectural Design

There is a primary VI that is the only VI the user has to interact with. The primary VI passes a selected file to a sub-VI which processes the image into an array and returns that array and the image dimension properties.

The sub-VI passes the image to a JPEG file reader which produces the dimensions of the image and a 1-D array of color values, in RGB format, meaning for every pixel of the image it retrieves the RGB values. So every pixel has 3 entries in the image data array, one for each color. The sub-VI processes this to get an absolute color intensity value, using a standard gray-scale conversion formula:

intensity in gray = 0.2989 \* intensity red + 0.5870 \* intensity green + 0.1140 \* intensity blue.

## Design Rationale

# Human Interface Design

## Overview of User Interface

The user picks an image through file path interface. The program displays the waveform from the IFFT and plays back an audio version of the signal, through a speaker hooked up to the DAQ or computer speakers.

## Screen Images