Acoustic Activated Light Generator

Software Design Document

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Contents

1. Introduction

a. Purpose

This software design document describes the architecture and system design of an acoustic activated light generator.

b. Scope

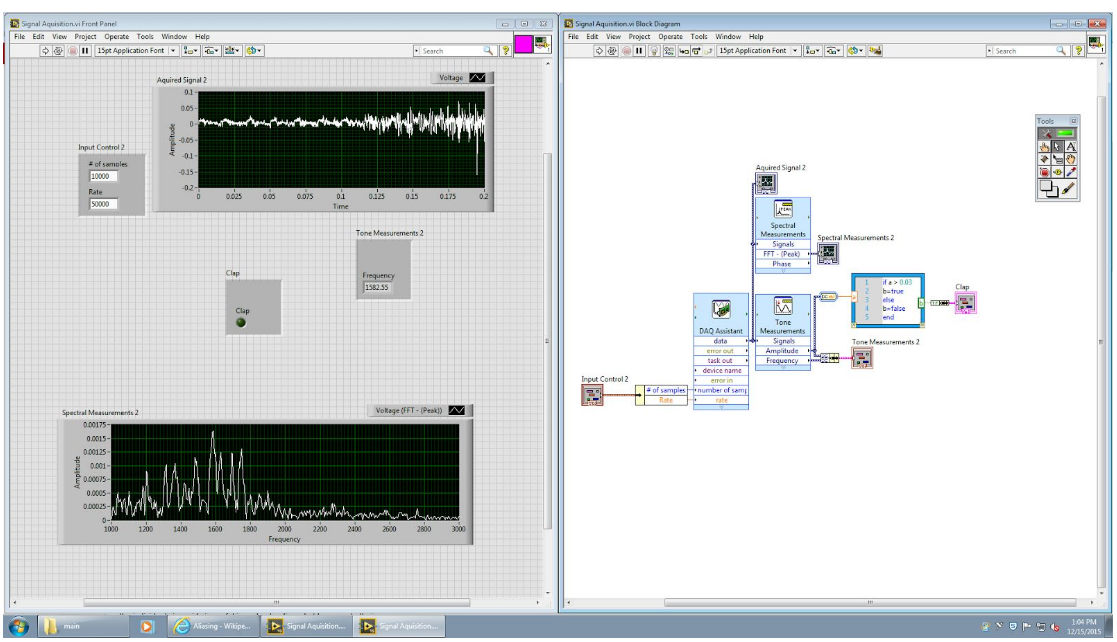
This software aims to analyze ambient sound and be able to discern if said sound is in the form of a clap or not. Once the correct clap sequence is detected the program will send out a signal that will switch a device on or off. The main goal is to develop turn-key system that allows anyone to easily control a light source or any electrical device with sound.

c. Definitions and Acronyms

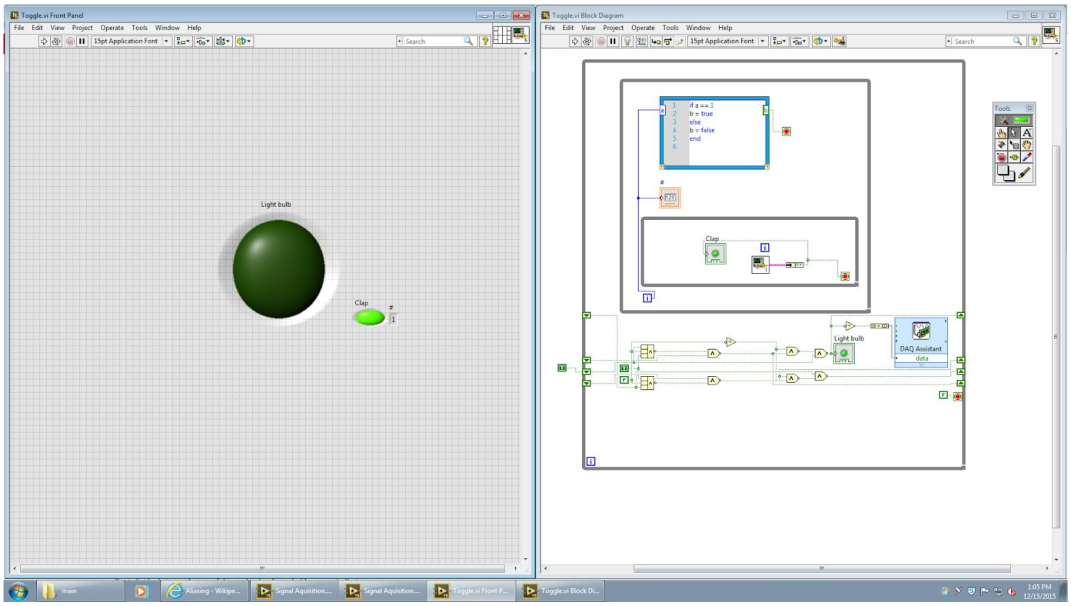
LV: LabView 2014 32-bit
DAQ: USB x Series Multifunction Data Acquisition

2. System Overview

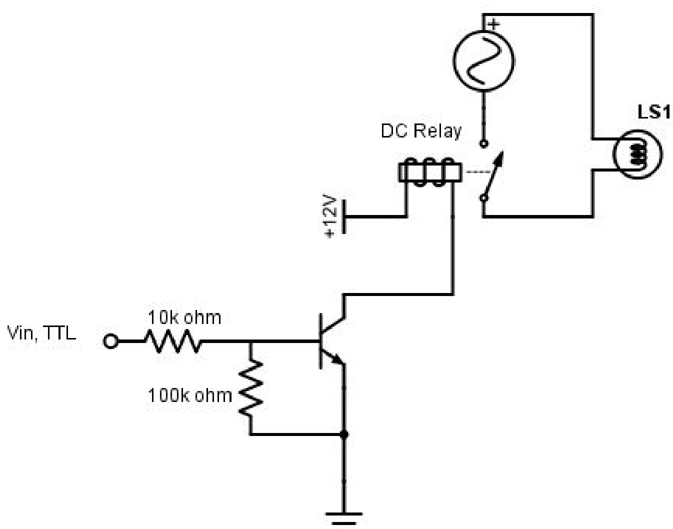
The system will primarily be dealing with sound. The device will be using an analog microphone that will act as the primary input for the device. The signals generated by the microphone will read out onto a waveform graph where it will be further analyzed. A frequency spectrum analyzer will be needed to analyze the signal from the microphone. Every sound detected by the microphone will a have a unique frequency spectrum. The image below is of the signal acquisition VI were the raw signal can be seen in the upper graph and the Fourier transform in the lower. The tonal measurements takes the raw signal from the time domain to frequency domain and outputs all the amplitudes within a percentage of a particular frequency. Our preferred setting was 20% and 1700 Hz. Above a certain amplitude would then count as a clap and triggering the next VI in the program.



It is then up to the toggle VI to generate a signal to send out to activate a switch. It consists of three while loops. The first is the signal acquisition which when tripped starts the second while loop. It counts claps and at 2 it stops. This toggles the flip flop circuit and the DAQ supplies 5 volts DC from the one of the digital ports.



This system will be dealing with both AC and DC signals. A circuit will be needed to interface a DC signal from the program with the AC current needed to activate the light bulb.



3. System Architecture

a. Architectural Design

The system consists of two pieces of hardware that communicate to each other through the computer via LV. The first piece of hardware will include the microphone which will need to be attached to an amplifier. This amplified signal will be pulled into LV by way of the DAQ. Within LV the signal's frequency will be analyzed and determine whether or not to activate the switch. This leads the second piece of hardware, the switch. This the most straightforward part, if the signal was determined to be a clap the switch is toggled and the light comes on.

b. Design Rationale

An analog microphone is preferred to digital because we would avoid additional software and drivers needed for another digital device. The 5 volts DC that the DAQ is able to provide is not sufficient to toggle the relay so found it necessary to have V_{in} control a larger voltage source with a npn transistor switch. Which would then in turn through the relay. The DC relay switch will also be used to deal with the AC-DC interface by isolating the DC and AC power supplies.

4. Human Interface Design

a. Overview of User Interface

The nature of our device does not require much human interface. There will be two led visible to the user, one green and one red. The green led will light when the microphone picks up a sound. The red will light if and when the LV program determines the sound is not a clap and so the user knows to try again if he or she did indeed clap.