Automatic Bedtime Audio Volume Adjuster

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Introduction

- Goal: Improve audio experience before sleep
- Audio compressor:
  - Decreases sudden loud sounds
  - Gradually decreases volume over time
- Relaxing imagery: responsive LEDs
High Level Block Diagram

Audio Out → Compressor → Timer → Amplifier

... → Delay → LED → Peak Follower → BPF → Speaker
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Power

- 12V 4.16A DC power supply
- 120V AC wall outlet power
- Common power rail throughout project
Line Level

- Standard audio-out line level used for each module
- Low impedance load expected from speaker/headphone
- Intermediate steps require voltage amplification
Audio Compression

- Reduce volume spikes with voltage controlled amplifier (VCA)
- Possible strategies (VCA):
  1. Control resistor value with a voltage (MOSFET, JFET)
  2. Multiply signal voltage with gain voltage
Possible Voltage Controlled Amplifier Implementations

- Build new circuit
- Study past VCA with linear response

Source: [1] Electronotes by Bernie Hutchens
http://electronotes.netfirms.com/
Possible Voltage Multiplier Solution

- Multiply to input - a gain function that depends on input signal
  - Use comparators to see if voltage breaches certain loud voltage
  - Attenuate signal if loud voltage breached
Gain function ~ 0 to significantly decrease final output voltage

Gain function ~1 to keep volume closer to original
Gradual Volume Reduction
- Timing circuit using a 555 timer and RC
- Time decay constant 20-30 seconds
- Gradually decrease the signal over time
Frequency Visualization

- Band-pass filters supply a DC voltage to different colors for different frequencies

![Diagram of band-pass filters and delays]
Delay Line Element

- Sample and hold DC signal
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- Takes smooth input
- Produces periodically stepping output
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Alternating clock signals
Timeline Weeks 1-2

- Week 1 (Apr 15)
  - DC Voltages produced by LED BPFs
  - Spikes in audio successfully compressed

- Week 2 (Apr 22)
  - Audio timer used to decrease signal over time
  - LEDs lit in response to audio
Timeline Weeks 3-4

- Week 3 (Apr 29)
  - Spike decrease / gradual volume decrease
  - Audio and visual components combined
  - Debugging
- Week 4 (May 3)
  - Full written documentation / presentation
Conclusion

- Project changes audio and visual stimuli before bedtime

- Potential Difficulties:
  - Decrease loud volume spikes to appropriate levels
  - Return to line level specifications reliably
Additional Goals

- Adjustable volume decay
- Switch to immediately turn off sound
- Different mode to not decrease volume until halfway time
- Sound equalizer to change bass levels
- Create a net or other geometry of LED lines
References

Source: [1] Electronotes by Bernie Hutchens
http://electronotes.netfirms.com/


Source:[3]