



Guitar Effects

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Problem Description



- The guitar effects are usually sold separately where each pedal corresponds to a single function
- Buying these pedals all separately can quickly add up:
 - Unnecessary additional costs
 - Extra pedals that need to be carried around
 - Additional wiring for each pedal
 - Increased risk for problems and malfunctioning
 - Additional interference/noise due to inductances in the wires from daisy-chaining & longer distances for the signal to travel
- Knobs on these pedals to control the amount of each effect being output are usually cheap and often break
- Some people are physically unable to use a foot pedal

Proposed Solution



- Our proposed solution is a digital rather than physical guitar effects “pedal”
- We will implement an online user interface that allows the user to choose their desired guitar effect and its intensity
- The goal is to emulate the various effects produced by guitar pedals in a manner that is cost-efficient without considerable sacrifice of audio quality.
- We will have separate circuits for each effect with a goal of building them in the most compact container and with low-cost circuit components unique sound effects
- With our design, we intend to increase both physical and financial accessibility to guitar effects
- By using low-cost basic circuit components and replacing a physical pedal with a website UI, we ensure that our device is affordable, more physically accessible, and simple to use for an improved user experience for a wider audience

Demonstrated Features

01

User can choose the guitar effect on a website
(successful creation of UI)

02

Selected guitar effect changes based on user input
(WiFi communication with UI)

03

Intensity of guitar effect changes based on user input
(WiFi communication with UI)

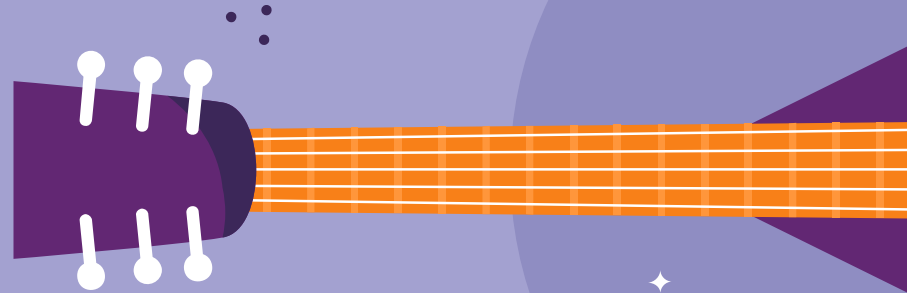
04

Multiple guitar effects are possible
(correct implementation of different circuits with the ESP32)

05

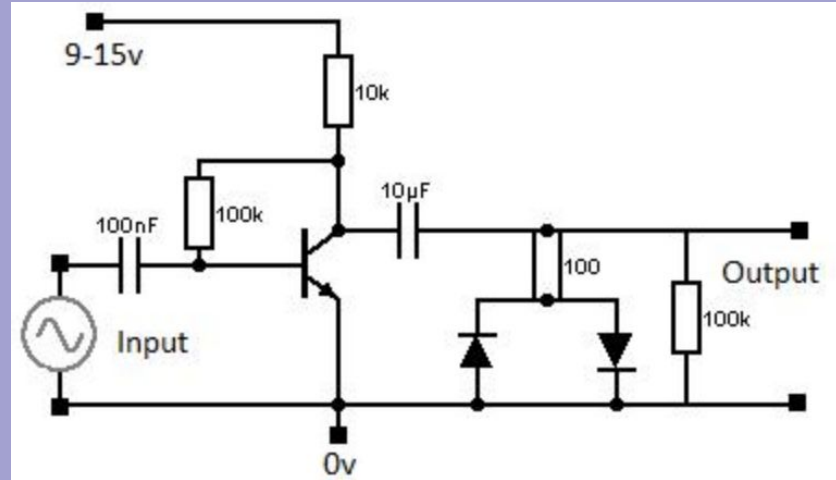
Audio signal has an effect applied but maintains intended pitches
(digital signal processing of audio input)

Available Technologies



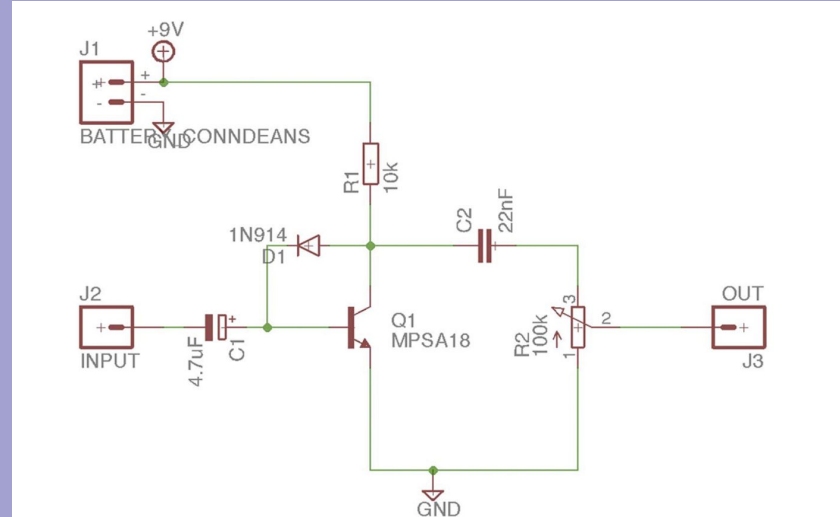
Distortion Effect

- Resistors: 100 Ω , 10k Ω , 100k Ω
- Capacitors: 100nF, 10 μ F
- Transistor: BC337
- Diodes: 1N4001 (2x)
- Potentiometer for 100k biasing resistor



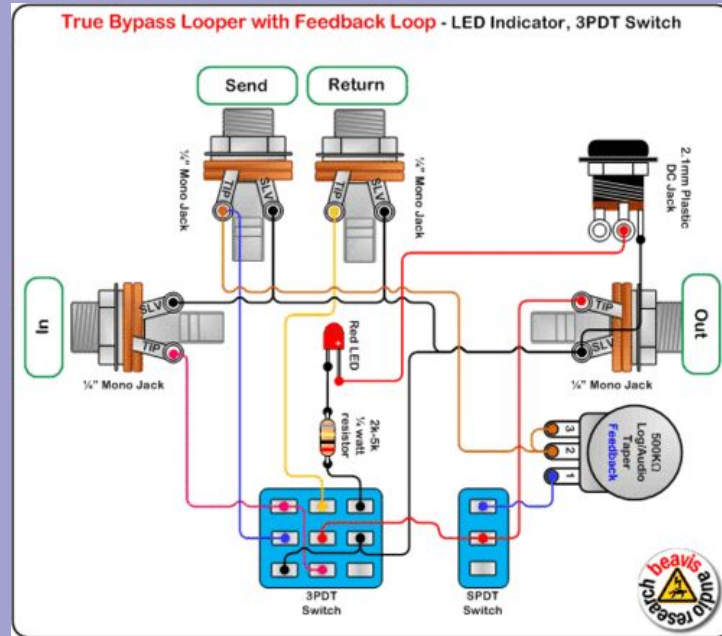
Fuzz Effect

- Resistor: 10k Ω
- Capacitors: 22nF, 4.7 μ F
- Diode: 1N914
- Transistor: MPSA18
- Potentiometer: 100k Ω



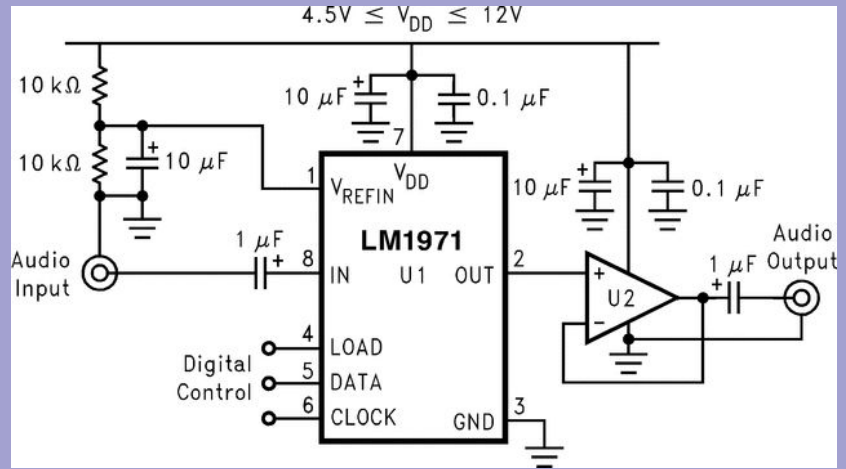
Loop Effect

- ¼" Mono Jacks (x4)
- Potentiometer: 500kΩ
- Resistor: 2kΩ - 5kΩ ¼ Watt
- 3PDT Switch
- SPDT Switch



Digitally-Controlled Audio Attenuator

- Resistors: 10k Ω
- Capacitors: 0.1 μ F, 1 μ F, 10 μ F
- LM1971, Op-Amp



Engineering Content

- Assemble circuits shown in schematics for the different effects
- Design bypasses and controls for circuits to allow the ability of adjusting presence of effects
- Build a housing for electronics with necessary inputs and outputs with as compact a design as possible
- Create a user interface (website) using wifi communication with the ESP32 that can enable/disable effects with the ability to control their levels allowing the user to customize the tone produced
- Perform digital signal processing on audio signals to achieve the desired effect without unintentional loss of frequency components
- Maximize the efficiency of the digital signal processing to minimize the latency so the guitar effect is heard “in real time”



Conclusion

- With our design, we intend to increase both physical and financial accessibility to guitar effects
- Our solution will:
 - Consist of 3 separate circuits, each capable of performing one effect:
 - Distortion, Fuzz, and Loop
 - Use a website UI for the user to easily choose a guitar effect and adjust its intensity
 - Take the input signal from the guitar and pass it through the desired circuit to the output
 - Have open switches on the effects we do not want to run
 - Pass the modified signal to an amplifier to hear the selected effect
- By using basic circuit components and replacing a physical pedal with a website UI, we ensure that our device is: affordable, more physically accessible, simple to use, and advantageous compared to using multiple pedals daisy-chained together.

