Team 8 - Voltage Vanguard
21 October 2024
Sierra Buckley
Chuong Vo
Eric Sanman
Chris Crider

Practicum Product Design Specification (PDS) Outline

Short Descriptive Name: PWM Synthesizer with built in display

Executive Summary with Concept of Operations (2 pts)

An analog & digital synthesizer in the form factor of a guitar pedal. The synthesizer uses the instrument input as control for the synthesizer. The synthesizer is intended for beginners and musicians alike. The synthesizer will have an aux and amplified output to connect an external speaker. The synthesizer will connect to a standard 9V power supply that is standard on a pedal board.

Brief "Market" Analysis (2 pts)

The intended customer demographic for the PWM synth would be entry level music enthusiasts or those looking to get into music production. The competition is a multitude of audio effects companies. Our product is different because it's locally designed and crafted, and creates a combination of effects that are typically uncommon and often do not come on a singular device. Market price for similar products can start at around $100 upwards. To market this product and stay competitive, we could start the price of the synthesizer at $75 for the base model and increase the price as more components are added.

Requirements (4 pts)

Must:
- Must be powered using 9V
- Guitar pedal form factor
- Must have a display, OLED or LED
- Must take in an instrument input ¼ inch jack
- Must have amplifiers to amplify input signals
- Must have adjustable potentiometers and buttons/switches to change effects
- Must have at least 2 analog effects
- Must have a audio output that a speaker can be connected to
- Must have digital control using a microcontroller, at least one waveform

Should:
- Should use a MIDI keyboard to control the synth
- Should have a high quality metal case
- Should have the microcontroller produce multiple waveforms or additional digital effects

May:
- May be battery powered
- May have more than 2 analog effects
- May be cat themed
- May cost less than $75

System Architecture (4 pts)

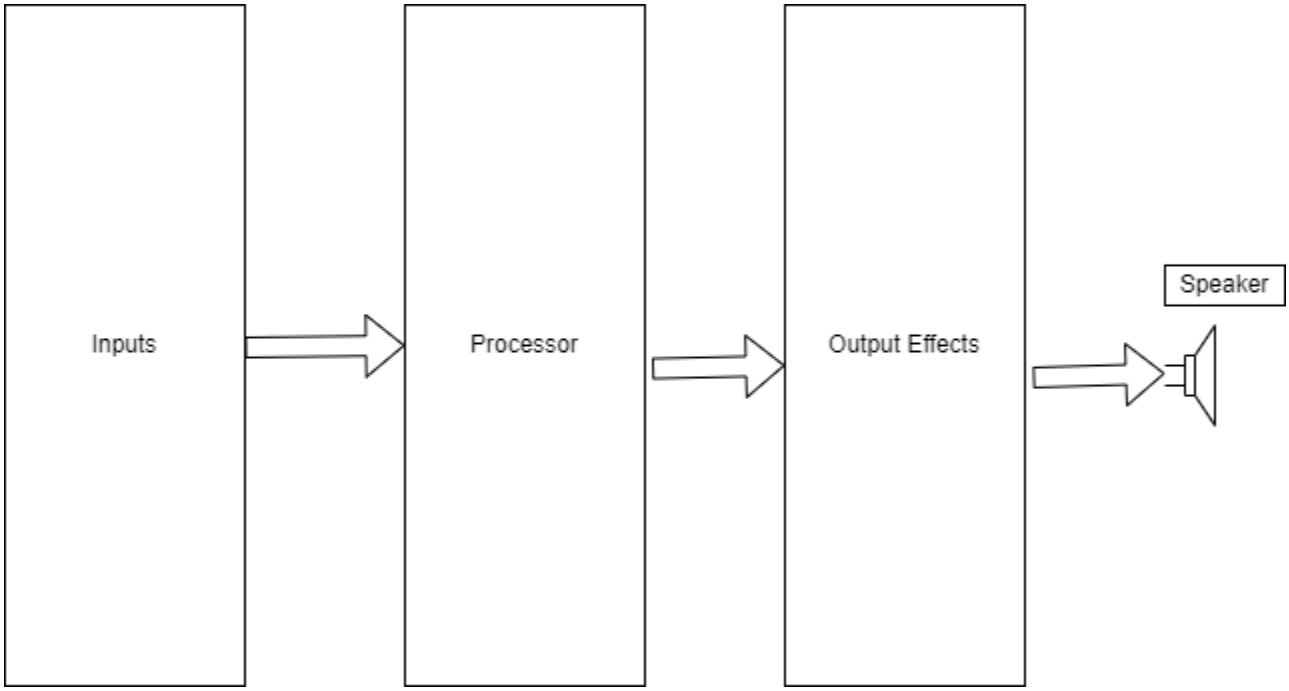

Figure 1: Level 0 block diagram

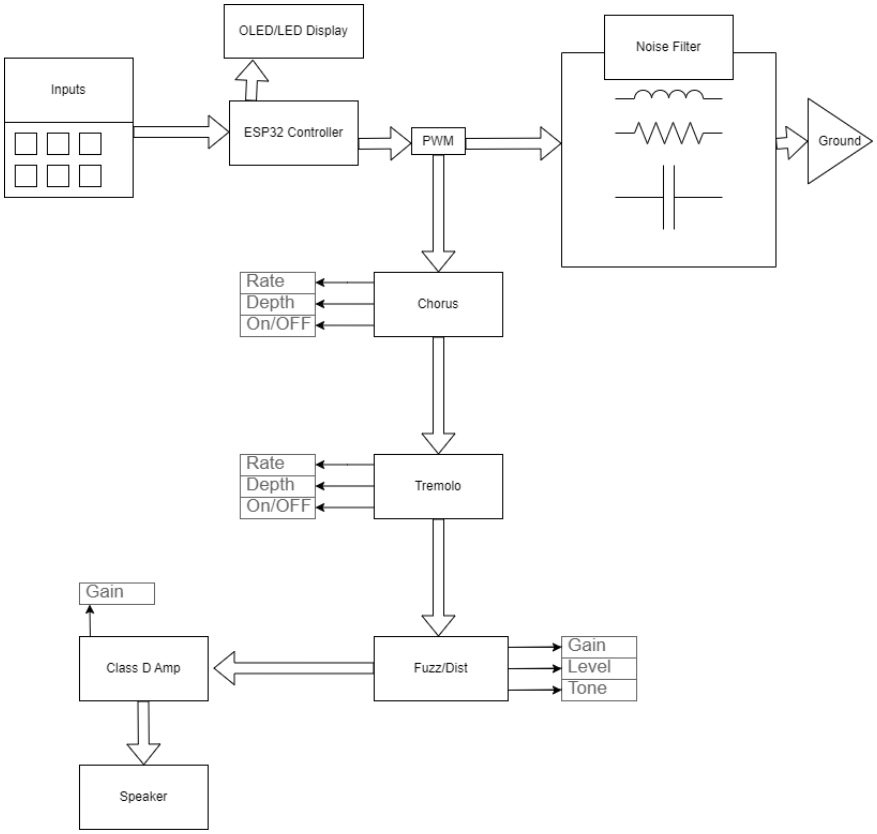

Figure 2: Level 1 block diagram

Design Specification (4 pts)

- Actuators
    - Outputs (speaker amp and line-level audio)
    - Displays
        - OLED
        - LED matrix (ex. 9x9)
- Sensors
    - Instrument input jack
    - MIDI keyboard input jack
    - Human input
        - Potentiometer
        - Buttons
- Controllers
    - ESP32-S3-WROOM (tentative)
    - Analog discrete logic
    - OP amps (filter, feedback, etc)