

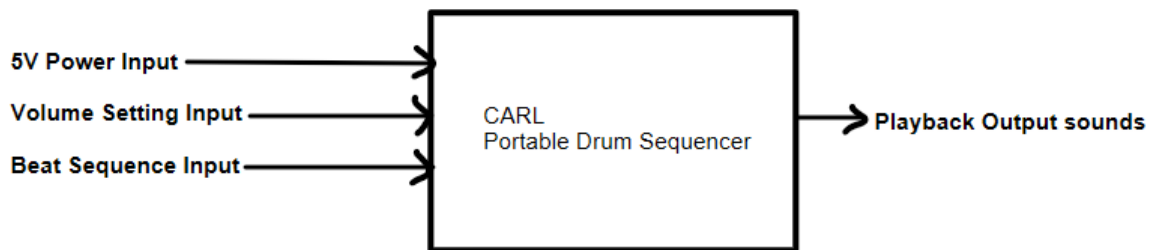
Practicum Product Design Specification (PDS)

- **Short Descriptive Name**
 - C.A.R.L.: The Clocked Asynchronous Rhythm Logician, a drum machine made to interactively and portably create sequences of musical beats.
- **Executive Summary with Concept of Operations (2 pts)**
 - A portable drum sequencer that plays and saves music sequences. Users can tap out a drum beat, save and clone patterns, and play back their beats through the on-board speaker. [Users can also apply basic effects and modulation to the sequence, for added customizability.]
- **Brief “Market” Analysis (2 pts)**
 - *Who are the intended customers / users?*
 - Music students, hobbyists, and sound producers of all kinds.
 - *What is the competition? Why is your product different?*
 - Competing with large name-brand musical equipment manufacturers (Korg, Yamaha, Roland, etc)
 - Also competing with more niche, hobbyist sound engineering products (teenage engineering, Analogue)
 - Our product/software is open source and customizable
 - No subscriptions, payment plans, DRM
 - No warranty-voiding internal hardware, fully repairable and destroyable!
 - *What price do you think you can sell this for, and why? (keep it short, we're engineers, not marketing researchers)*
 - 50 dollars, since most commercial options are over \$100.
- **Requirements (4 pts)**
 - Must sequence music beats
 - Must play back sequenced beats
 - Must include a speaker
 - Must include volume adjustment
 - Must operate independently of a computer or other audio equipment
 - Must have buttons for parameter changes
 - Should have audio effects
 - Should be contained in an enclosure
 - Should have MIDI output
 - Should have multiple tracks / polyphonic sound
 - Should have display for polyphonic voice / pattern parameters
 - May have audio line out
 - May allow the user to add new sounds
 - May be battery powered

- **System Architecture (4 pts)**

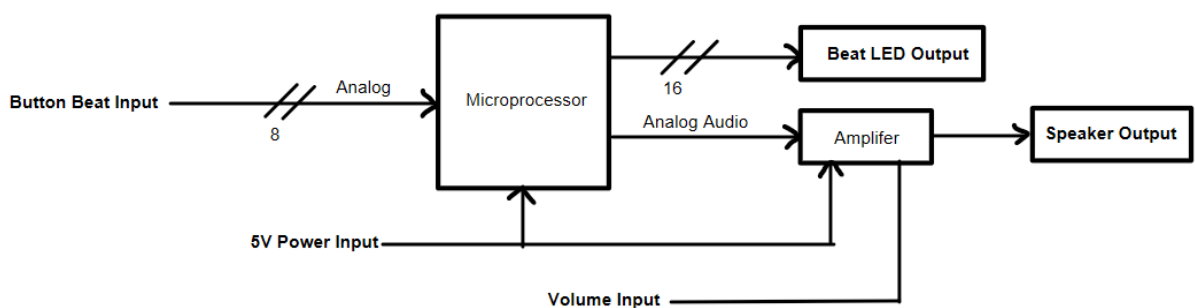
- Level 0

Level 0 Block Diagram



- Level 1

Level 1 Block Diagram



- **Design Specification (4 pts)**

- Sensors
 - Buttons: basic small switches
 - Volume: potentiometer
- Processor: ESP32
 - Firmware: Arduino framework
- Actuators
 - Beat LEDs
 - Speaker (8ohm speaker)
- Power
 - 5V from wall adapter
 - Optional battery power
- Mechanical Design
 - Enclosure: laser Cut plywood + 3d printed components
- Development environment
 - KiCAD
 - Fusion360
 - PlatformIO