The Beep Boop 9000

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What Is It?


AUX OUT
UNDO
EXP
LOOP VOLUME
IN 1
IN 2
MASTER VOLUME
PRESET (PUSH = LOAD) (HOLD = SAVE)
STOP MODE
INPUT SPLIT
SERIES LOOPS
SYNC MULTI
OUT 1
OUT 2
PIGTRONIX
INFINITY
LOOPER
ARM
LOOP 1 PLAY / REC / DUB
LOOP 2 PLAY / REC / DUB
STOP
USB

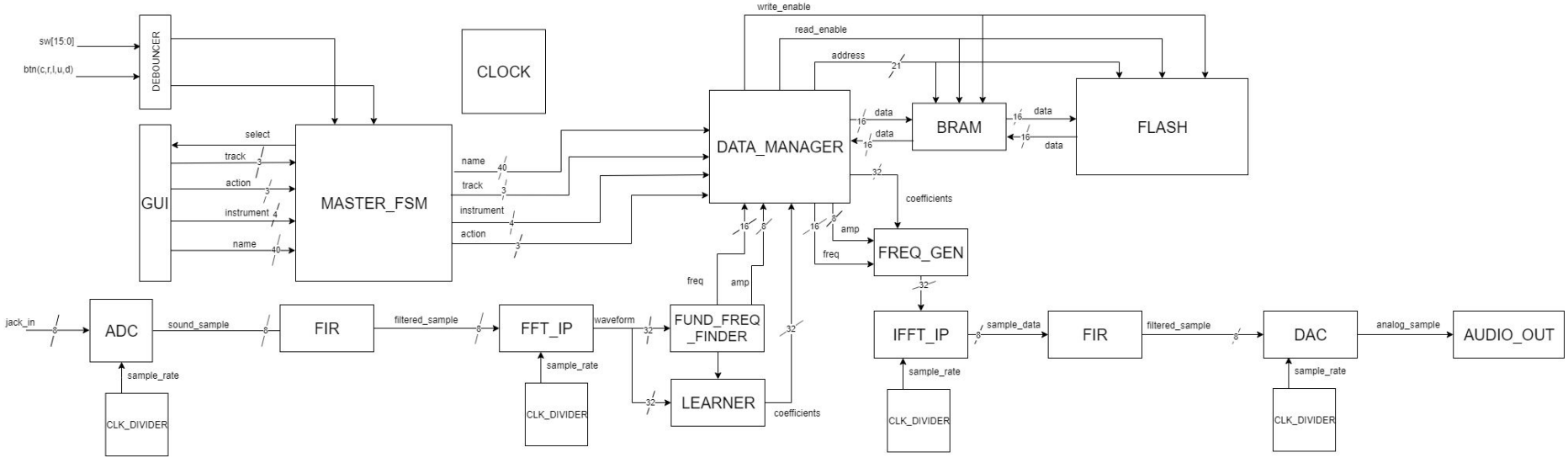
+


MICROBRUTE
Arturia

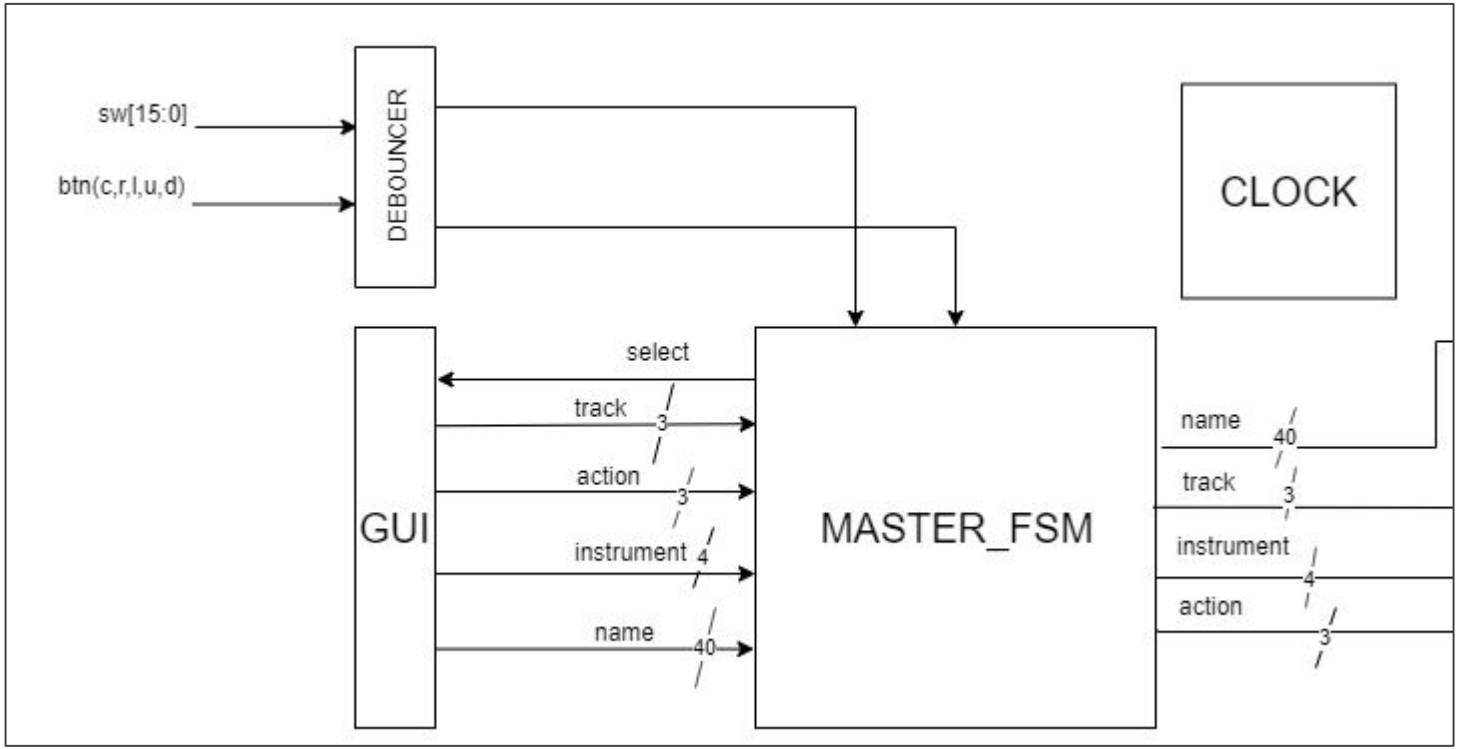
What It Does

- Audio suite that allows for looping, synthesis and multi-track playback
- The commitment: multi-track playback, fundamental frequency identification, preset instruments
- The goal: learning synthesizer
- The stretch goal: real-time instrument conversion

Block Diagram

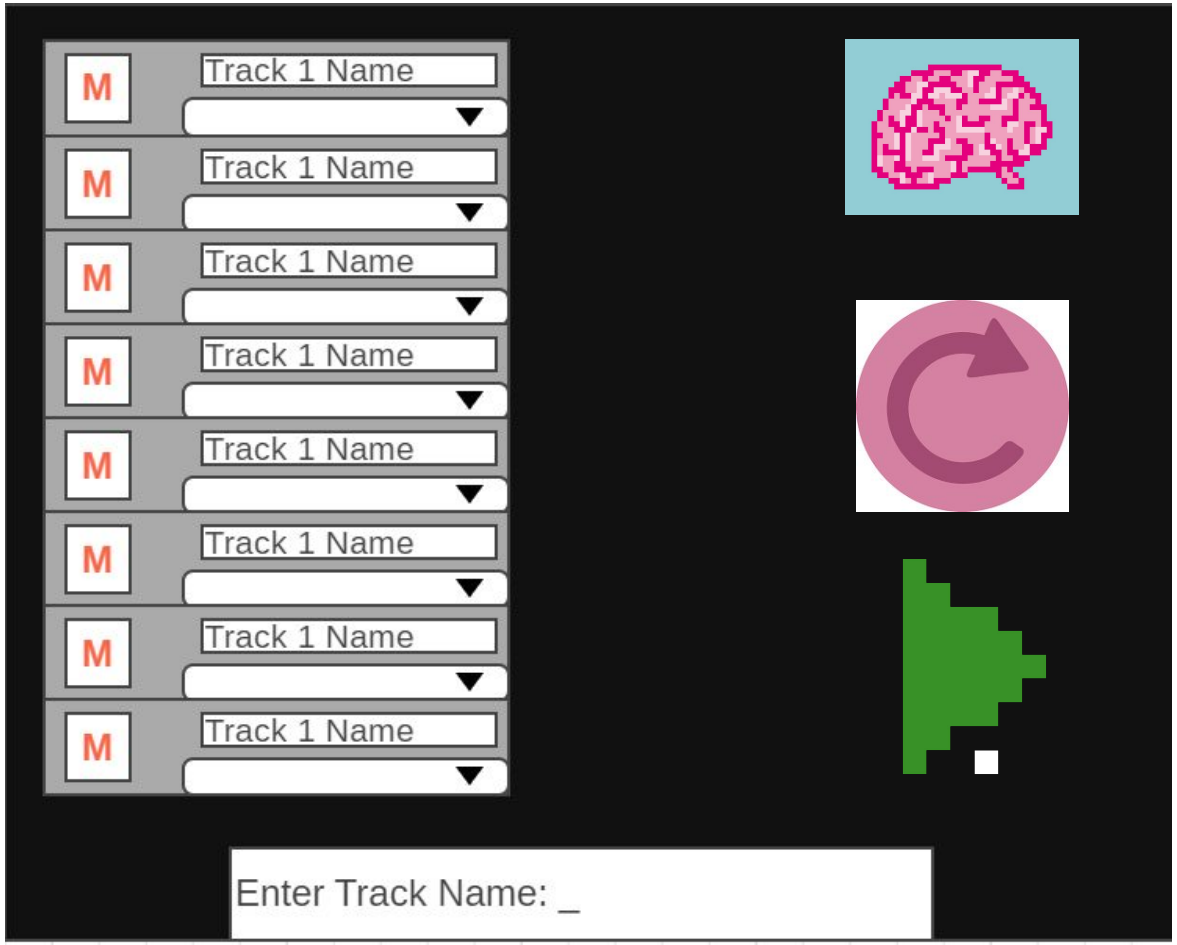


GUI

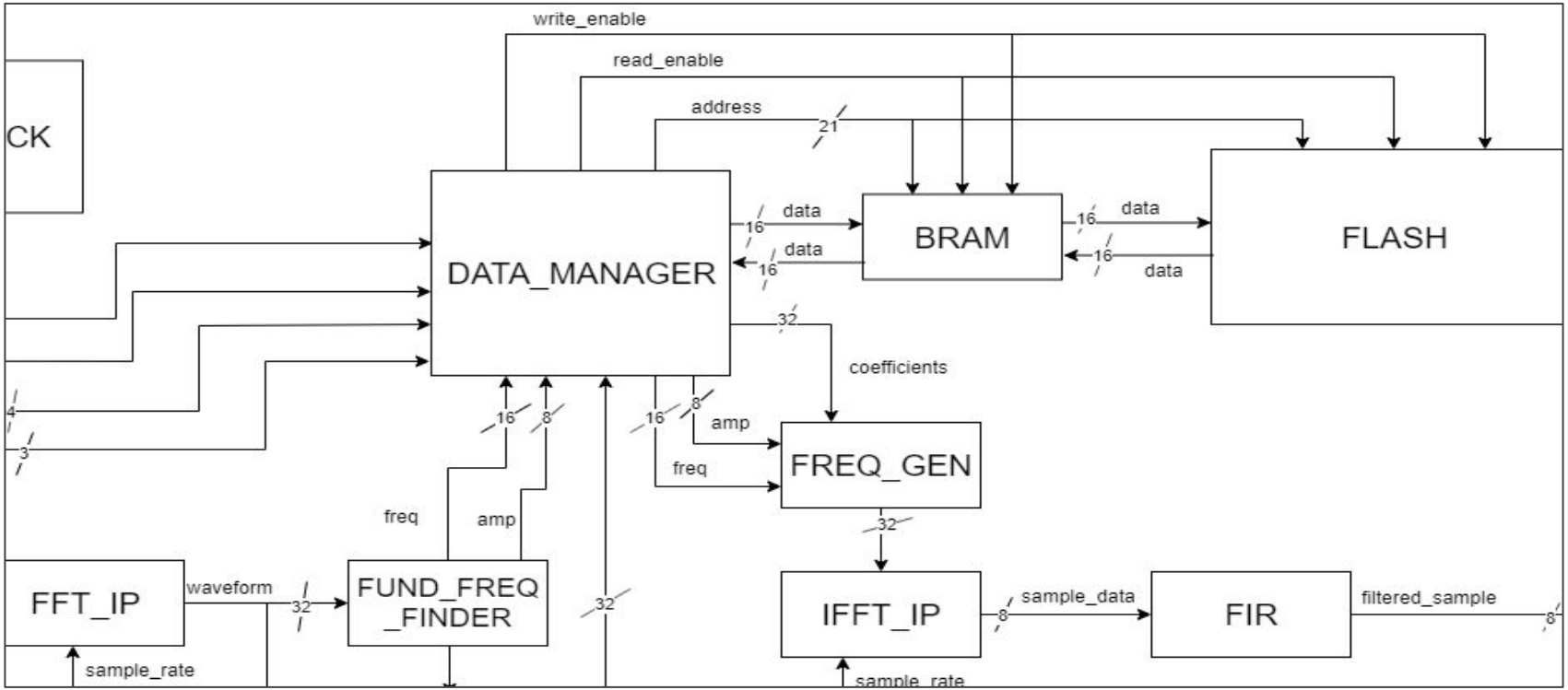

sw[15:0]
btn(c,r,l,u,d)
DEBOUNCER
CLOCK
GUI
MASTER_FSM
select
track
3
action
3
instrument
4
name
40
name
40
track
3
instrument
4
action
3

GUI

- 3 Sections:
  - Status Bar
  - Mode
  - Tracks
- Mouse Integration
- Drop-down menus



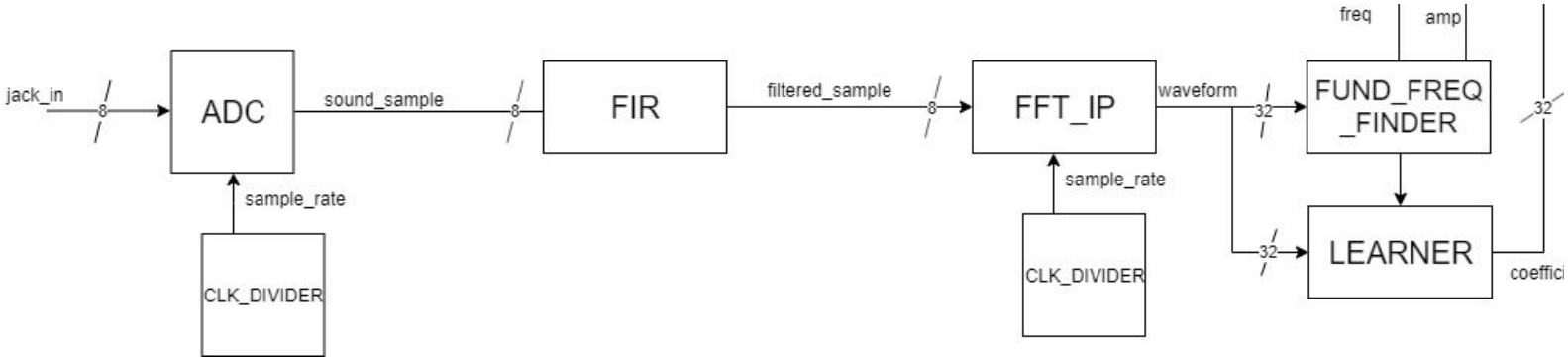
Data Management



Data Management

- BRAM
- SD Card
- Storage Items:
  - Audio
    - Frequency
    - Magnitude
  - Coefficients
  - Names

FFT and Fundamental Extraction



Flow:

1. ADC - 20kHz
2. FIR - Low Pass Filter
3. FFT_IP - 500Hz
4. Fundamental Finder
5. Learner

FFT and Fundamental Extraction

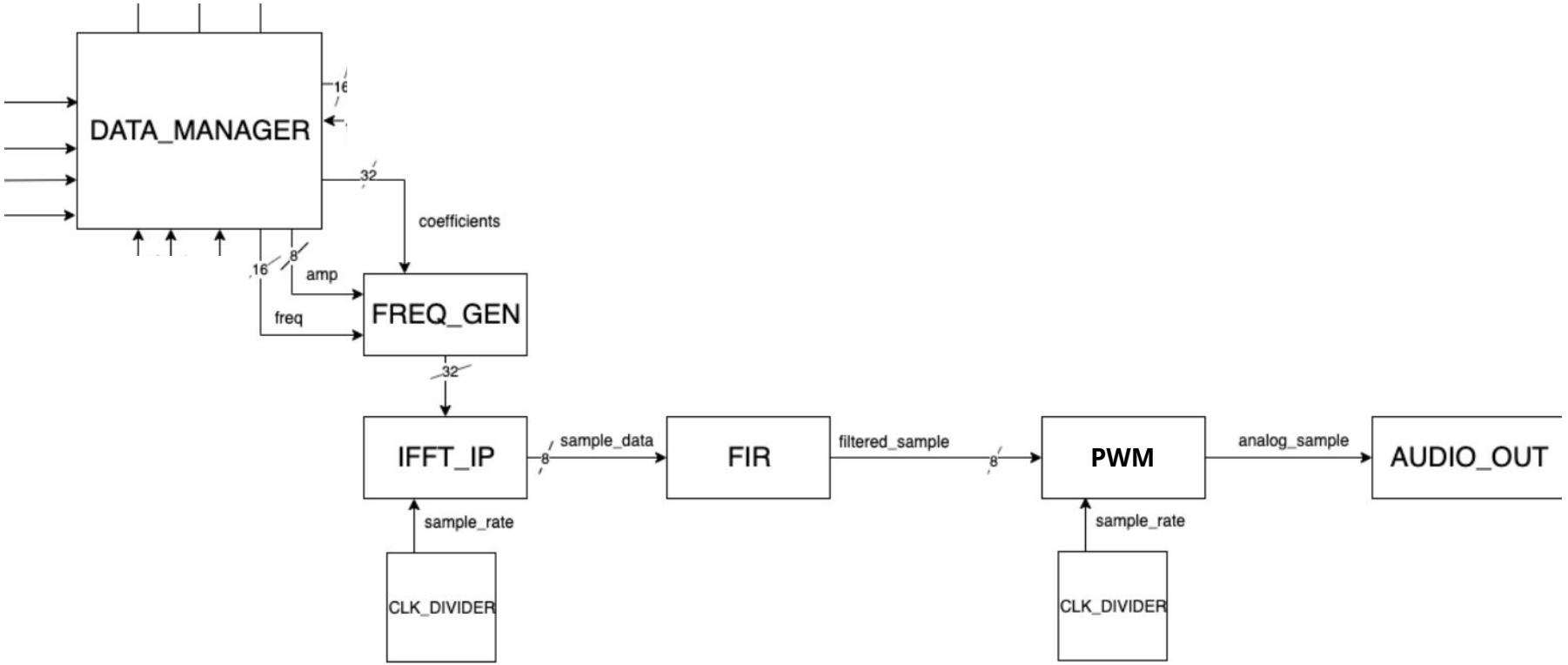
Base:

- Single note identification
- Maximum bin for fundamental identification
- Assuming ideal harmonic structure

Extended:

- Gaussian convolution for frequency identification

Coefficient Adjustment and Waveform Reconstruction



Coefficient Adjustment and Waveform Reconstruction

- Uses harmonic coefficients that correspond to a particular instrument to turn a fundamental into a textured sound
- Main challenge will be optimizing the IFFT
- Phase offsets for harmonic waveforms
- Artifact of FFT/IFFT frequency

Timeline

Week 1: Demonstrate input and output from FFT and IFFT

Week 2: FFT/IFFT from jack in, fundamental identification

Week 3: Instrument learning, integration/debugging

Week 4: More time for debugging, stretch goals