Project definition:

1. Problem analysis

Description of Problem

Which problem occurs?

-take existing audio samples and manipulate it in a creative way to create something new

-digitial signal processing

How does the problem manifest itself?

-fast and parallel read out of memory needed for latency free playback of multiple samples

-how is the audio processed to achieve this?

-what is needed implement functions/ processing options to rotary encoders?

In which areas of the company or for which products or processes does the problem occur?

-problem occurs in development of digital hardware samplers or at music creation (missing device)

Current state analysis:

-research, self-enrollment, visualizing the prototype and defining most important functions

- Since when does the problem occur? Problem since 1969(first digital sampler EMS Musys-system), commercially since 1976, polyphonic since 1979

Type of employees:

5 persons (coder/programmer, user, project manager, engineer, UI-designer)

Equipment:

Microcontroller by teensy is used, rotary encoders, display, SD Card, breadboard, etc.

technical environment:

C++, Teensy Audio Library, development environment for teensy (Arduino)

Analysis of the causes of the problem:

Back in the day Melotron-> Tape based sampler-> heavy and expensive because of tape mechanism-> limited to three octaves.

Today nearly no limits, everything can be processed digital.

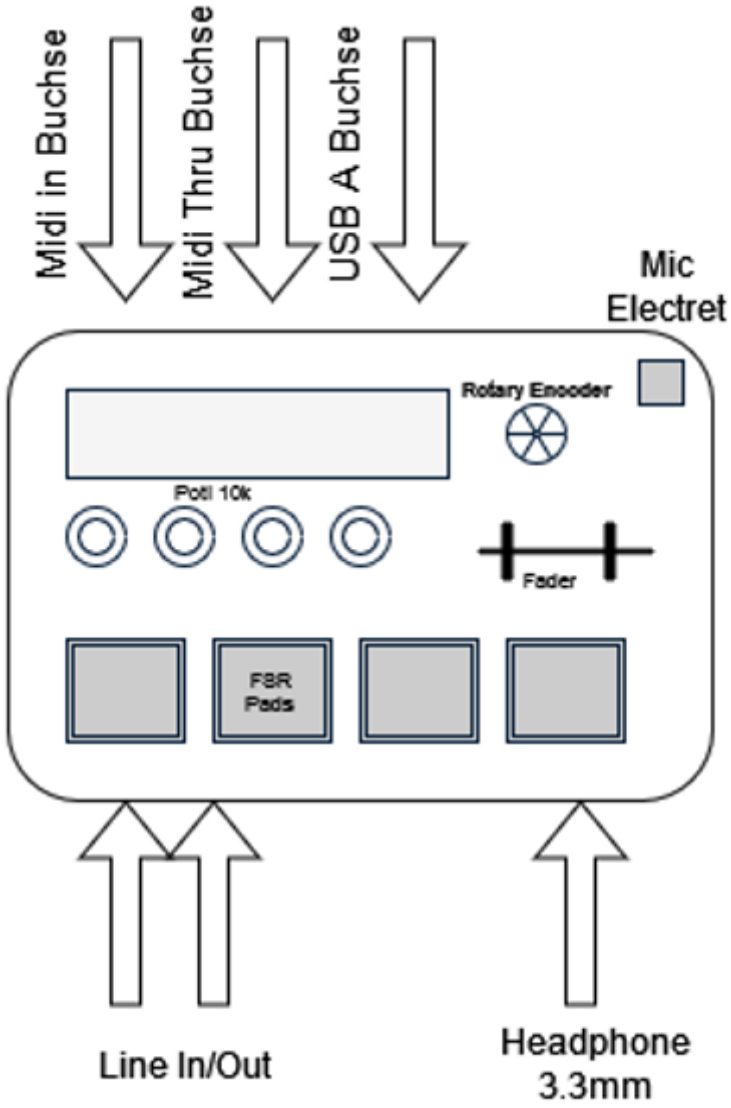
Cause lies in the use of equipment. The Teensy 4.0 provides computing power and ram storage, so we are technically limited to for example 2-4 different audio samples that can be played at once. Problem causes new problems-> how do we implement all these functions to solve the problem from the beginning?

2. Project goal

The primary goal is to read audio samples from a SD Card and load these into the ram of the Teensy microcontroller. This allows us to play multiple samples, at least up to 4, simultaneously via Midi. To select the samples the machine needs to have a display, so it is

easier to organize the selection of individual sounds. The sampler will also have a headphone jack, a microphone and a rotary encoder to brows the samples.
Secondary goal is to implement audio effects like filters, reverbs, delays, etc. And a master volume knob should be added.

3. Design of project results („solution concept “)



4. Feasibility analysis

All required materials are available on the Internet and cost around 100 euros per person.
Many functions are already included in the provided audio library of the Teensy microcontroller.
Any risks can be partial employee absence due to illness, but also unforeseen complications when implementing functions.
Effort and success are in a healthy relationship to each other.

5. Project contract / project order

Project name:
MHS - Mobile Hardware Sampler
Project leader:
Dennis Oberst

Project occasion:
Pam 3 Project, interest of project members to build themselves a hardware sampler

Project goals:
Read samples from SD Card to ram, trigger samples simultaneously with midi keyboard or 4 implemented buttons/pads, select samples with rotary encoder and display, master out volume control, build a case and make the sampler battery powered for mobile use with headphones (or speakers(intern and extern)).

Results to be worked out:
1.Basic effects on master out: EQ, delay, reverb, limiter-> control via rotarys
2. Record a loop via MIDI (4/8 bars), limited to 4 channels with random button assignment
Optional: Velocity sensitive pads/Drumpads, Granular synthesis, editing the start and end of sample

Project budget: Around 100€ per person

boundary conditions: Order only from German distributors, no child labor, 5 months until presentation
Dates and milestones: 31.08.2022 project deadline 12:00h

Signatures: Dennis Oberst, Lena Wilbertz , David Mertens, Lucas Haupt, Alexander Kostenko

6. Project organization

Project leader: Dennis Oberst, actually everybody involved but Dennis has most knowledge

Project team: Lena Wilbertz , David Mertens, Lucas Haupt, Alexander Kostenko

Project infrastructure: Room-> at home, computer, internet (discord etc.)

Work equipment: Computer, microcontroller with all the extras, maybe multimeter

Services: TH Köln 3D printer/ workshop for building case.

Project information system: Discord for quick chat and video/voice meeting, Github for code, JetBrains Space for assigning and organizing tasks and scheduling, regular meetings on the status, next steps and reviews, presenting results