Pineapple ONE

Homemade 32 bit RISC-V CPU

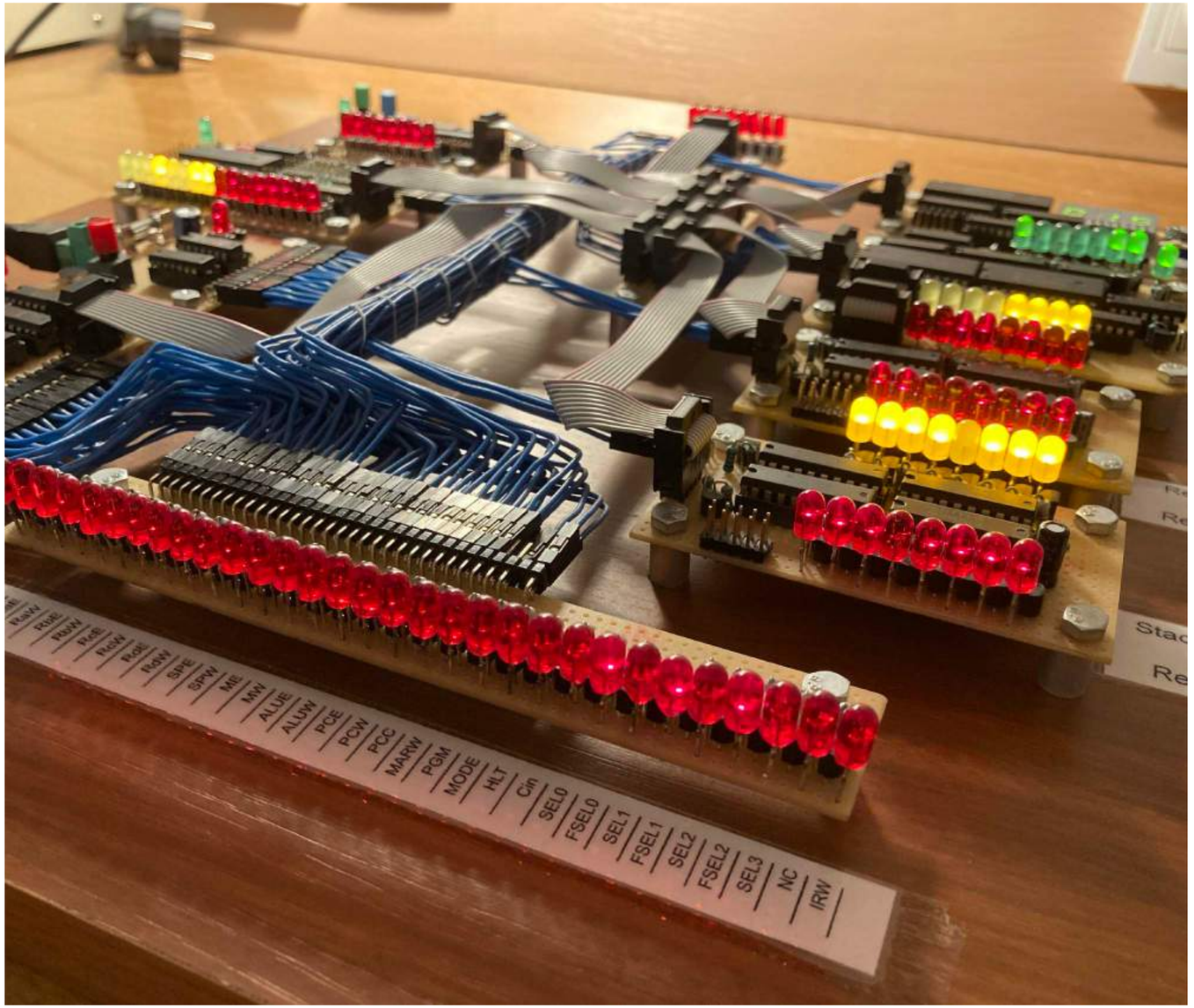
Filip Szkandera, Czech Republic

@ten_filip | filip.szkandera@gmail.com

About me

- Student of Higher School and Secondary School of Electrotechnical Engineering in Olomouc
- Big fan of RISC-V!

My first homemade CPU



Why RISC-V?

- Based on RISC
- Open source

Sneak peek

Without the case

With the case

CPU Core specification

32 bit RISC-V compatible CPU

RV32I

Discrete electronic parts

Clock frequency: 500 kHz

All in one (RAM, I/O, ...)

Features

9 PCB modules

Integrated VGA card

4 I/O ports

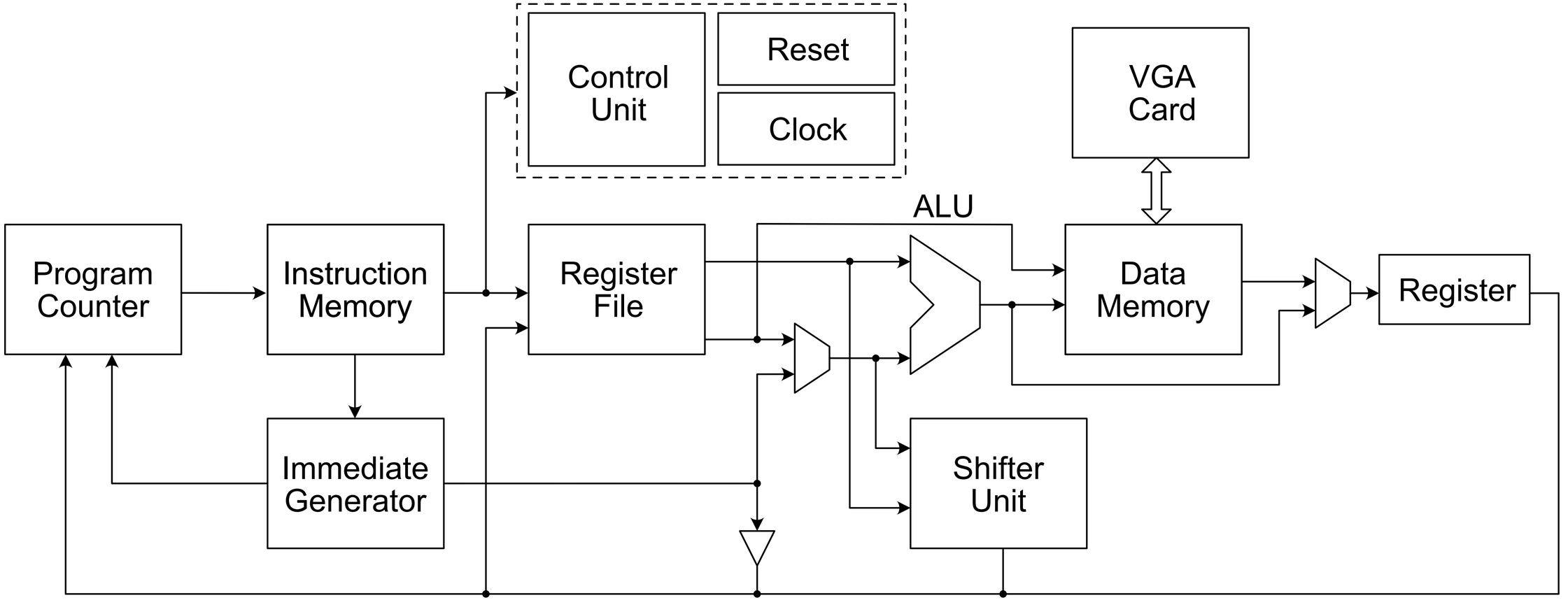
USB-C power

3D printed enclosure

Features

VGA card
Program memory
Transport layer
Shifter
ALU
Register file
Control unit
Program counter
Instruction memory

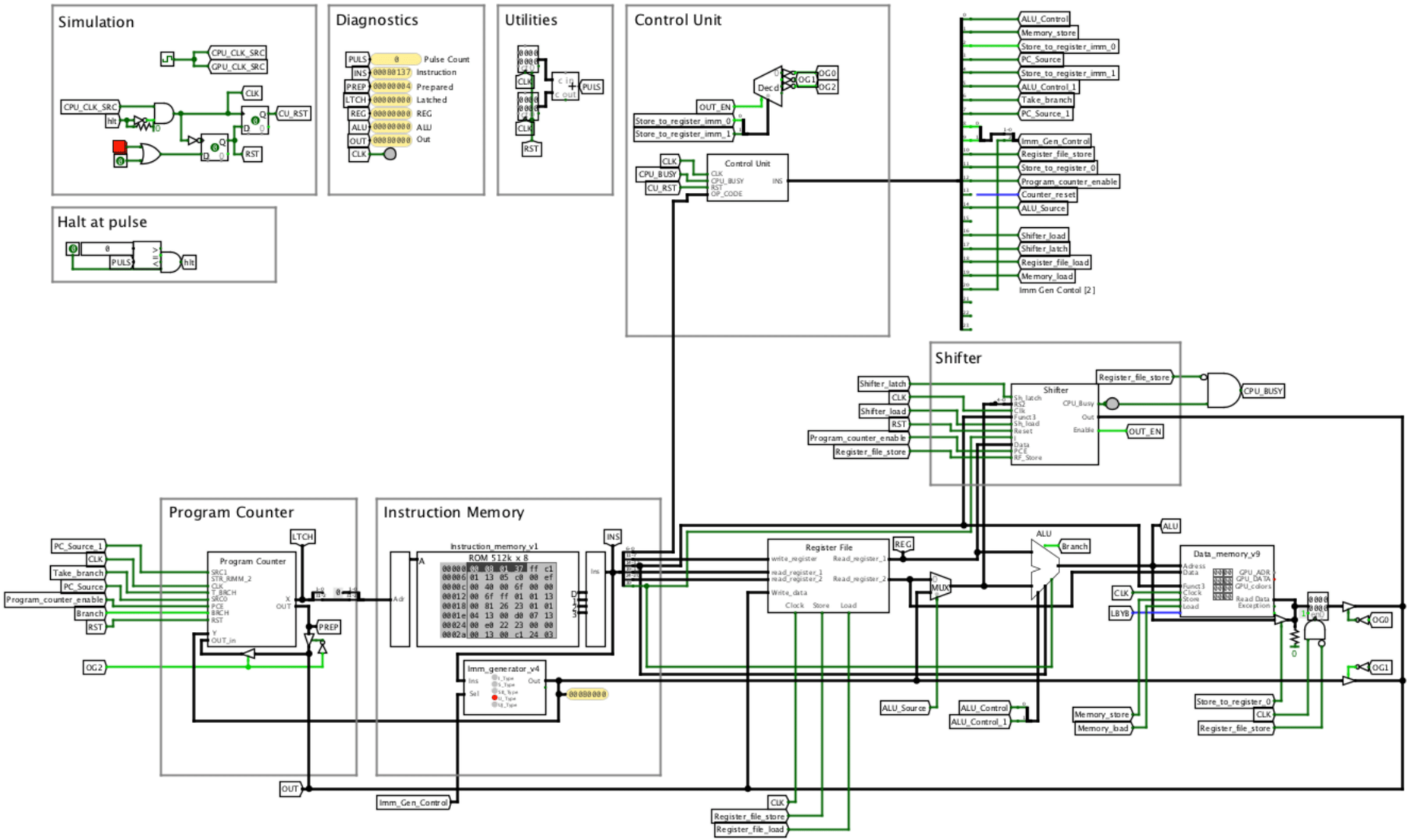
Block diagram

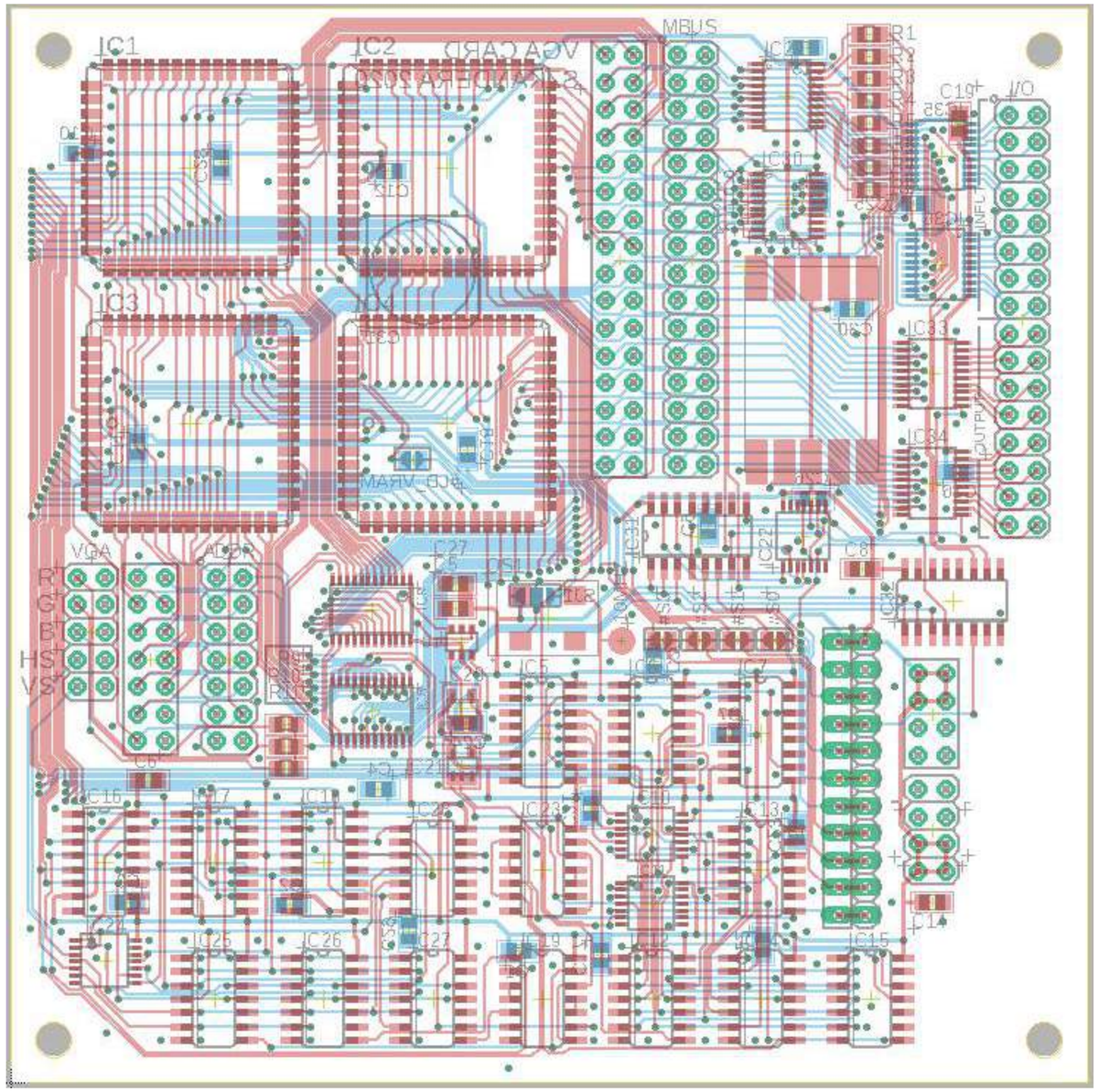


Project phases

- Simulation (5 months)
- PCB design (8 months)
- Prototyping & Debugging (5 months)
- Final product (4 months)

Simulation


Simulation
CPU_CLK_SRC
GPU_CLK_SRC
CLK
CU_RST
RST
Diagnostics
PULS
INS
PREP
LTCH
REG
ALU
OUT
Pulse Count
Instruction
Prepared
Latched
REG
ALU
Out
Utilities
Control Unit
OUT_EN
Store_to_register_imm_0
Store_to_register_imm_1
CPU_BUSY
OG0
OG1
OG2
ALU_Control
Memory_store
Store_to_register_imm_0
PC_Source
Store_to_register_imm_1
ALU_Control_1
Take_branch
PC_Source_1
Imm_Gen_Control
Register_file_store
Store_to_register_0
Program_counter_enable
Counter_reset
ALU_Source
Shifter_load
Shifter_latch
Register_file_load
Memory_load
Imm Gen Contol [2]
Halt at pulse
Shifter
Register_file_store
CPU_BUSY
OUT_EN
Program Counter
Instruction Memory
Register File
ALU
Branch
Data_memory_v9
Imm_generator_v4
PC_Source_1
Take_branch
Program_counter_enable
Branch
LTCH
PREP
OUT
Imm_Gen_Control
LBYE
ALU_Source
Memory_store
Memory_load
Store_to_register_0
Register_file_load

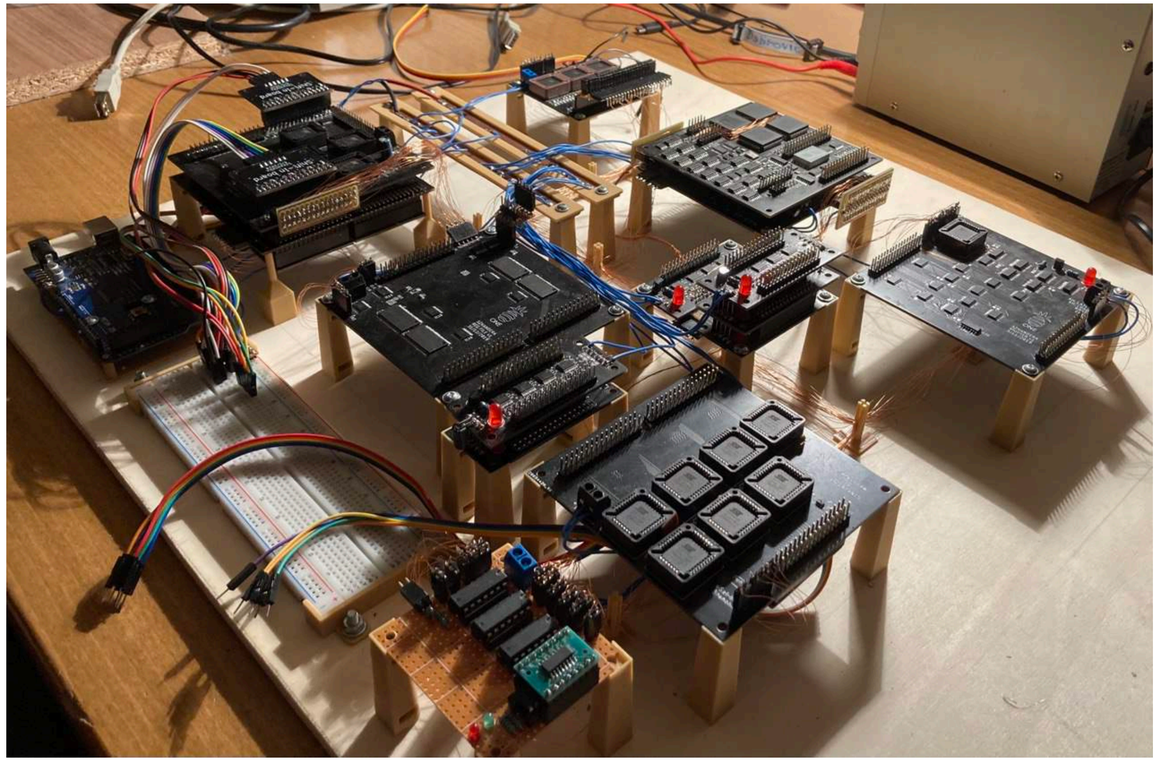


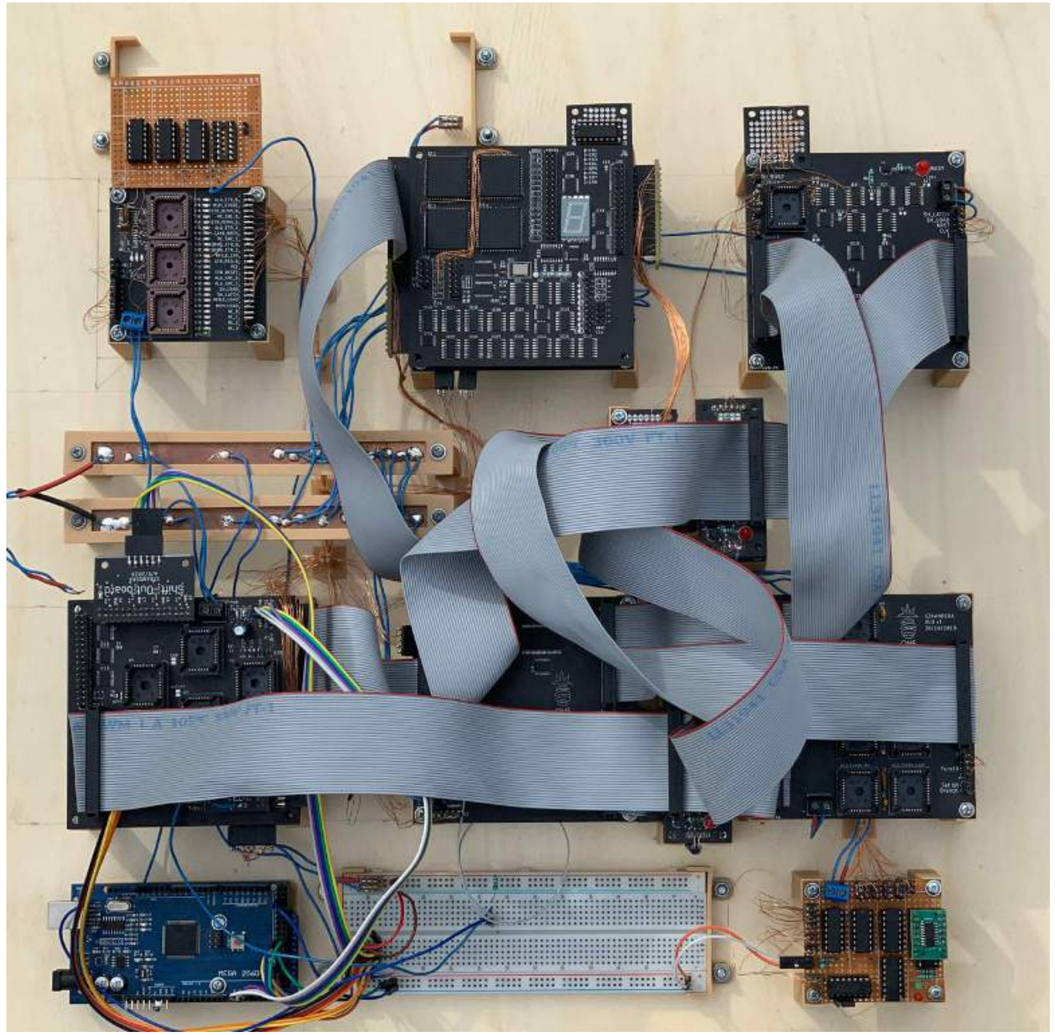
PCB design in Autodesk Eagle

Manufactured by JLCPCB in China

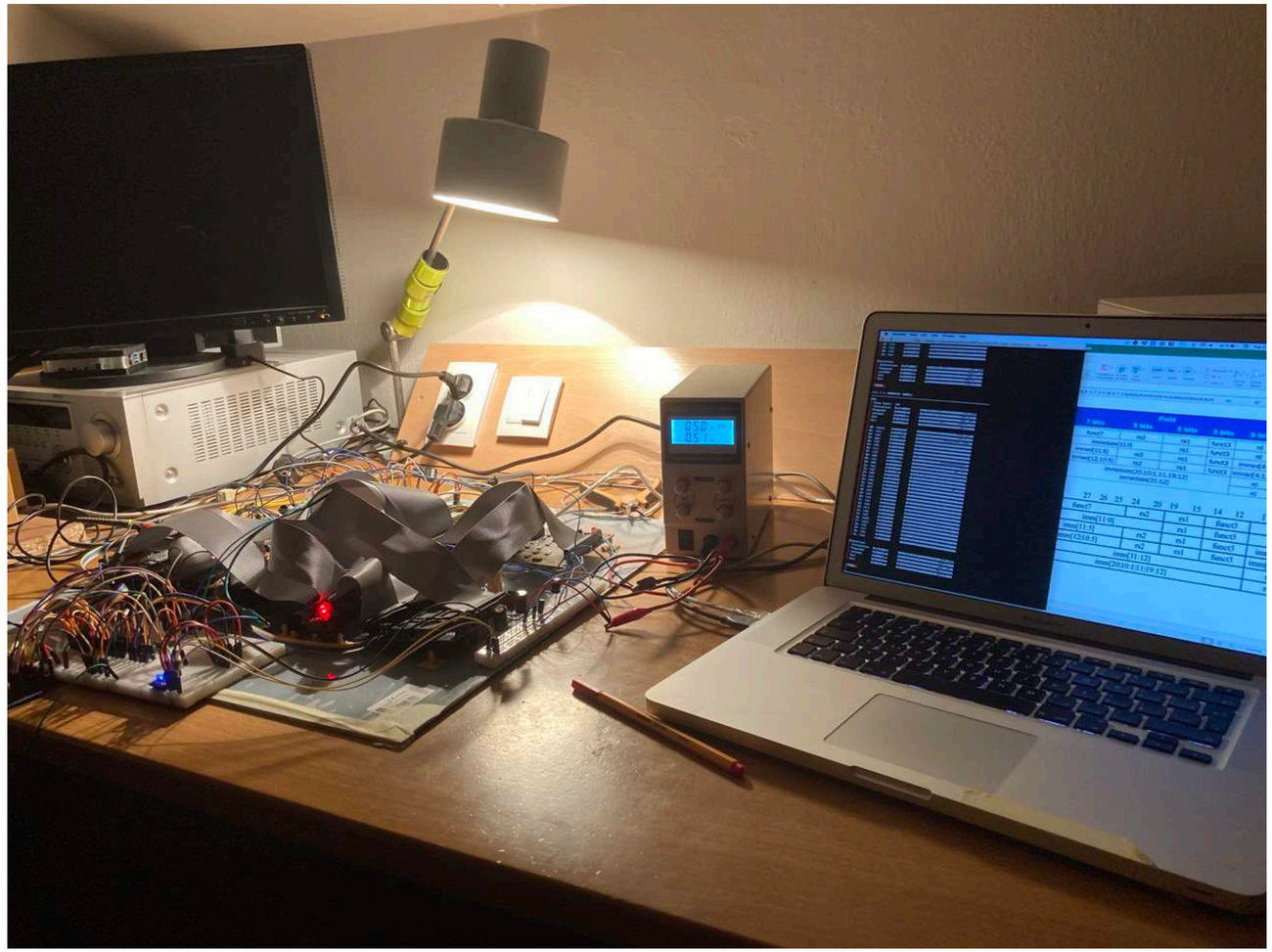
Hand-soldered

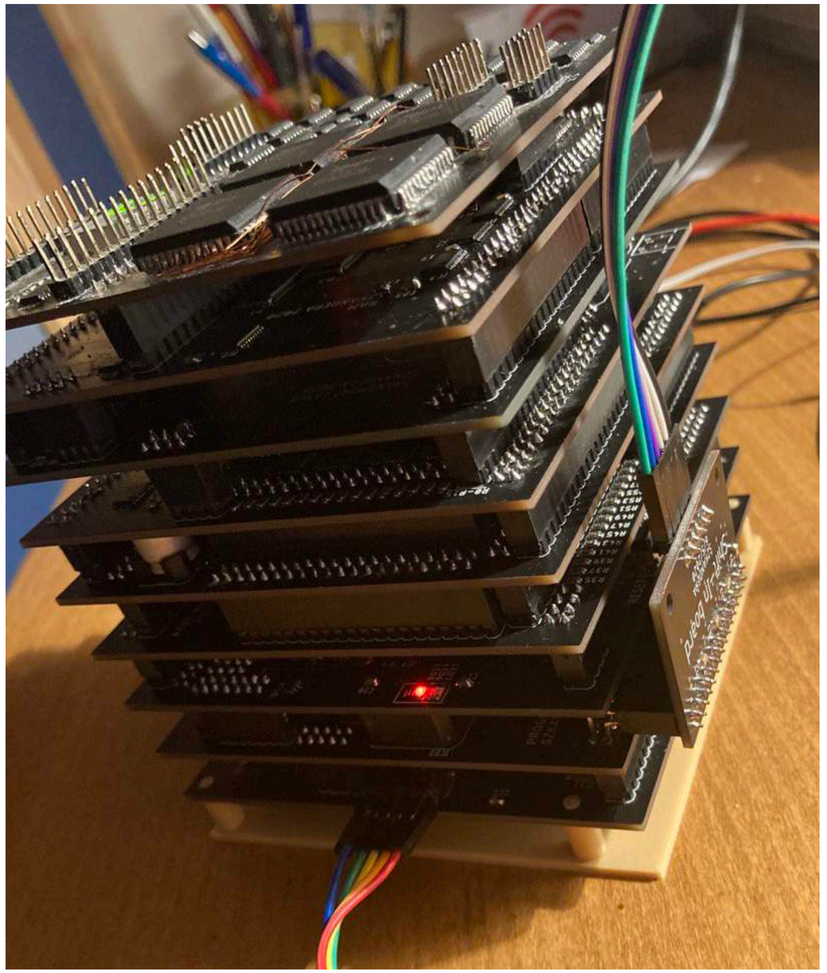
Pineapple ZERO





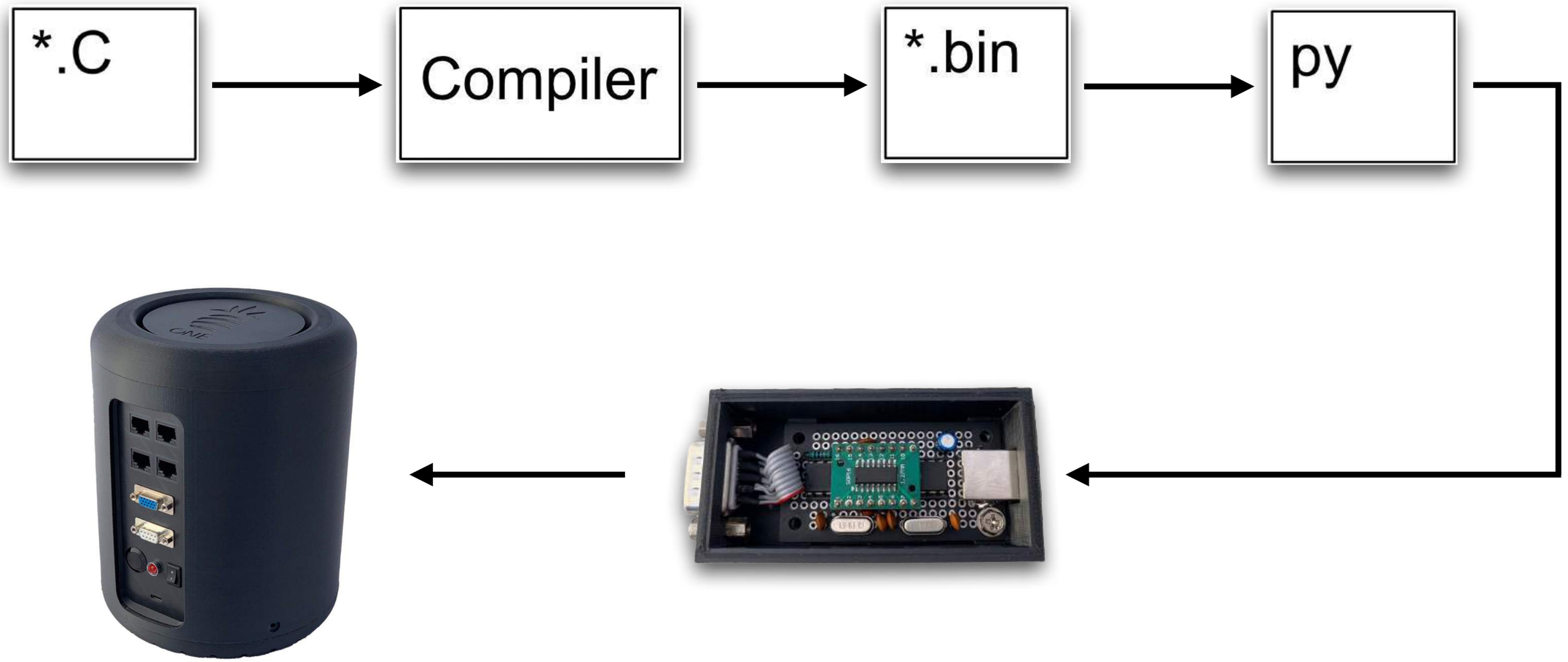
Debugging





Final product

Programming



Live demo