

6CCS3PRJ

The BreadBoard Computer

Luca-Dorin Anton

Supervisor: Christian Urban

Project motivation and scope

- Goal:
 - vertically integrate a machine architecture from the SSI (Small scale integration) circuits i.e. Logic Gates
 - Write different machine code languages for it
 - Write an LLVM IR backend so that you can run anything on it
- Why:
 - Create an understanding of how a computer works at all levels of abstraction (hypothesis: if they stop looking at computers as black boxes, students will have a much easier time understanding high level concepts which are actually used, like programming language design paradigms)
 - Create a vehicle/instrument for teaching machine architecture in a new hands-on approach (by bringing MARIE from CS to life)

Current Challenges

- Learning:
 - Logical Circuit Design, Machine Architecture Design, Chip Choices
 - LLVM, LLVM IR, How to write an LLVM backend
- Funding:
 - Most expensive component: Breadboards (Chips are actually really cheap!)
 - Student opportunity fund, support from module Lead, KCL robotics, own
- FPU Design? :
 - Can't seem to find anything detailing how to build a simple FPU. I just want to add floats in hardware :/ .

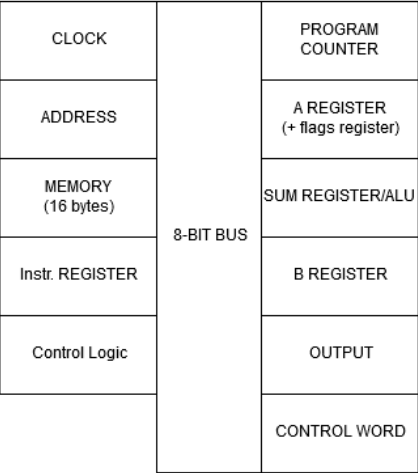
Future Planning

- 2 weeks -> finish reading up on literature, (both hardware and LLVM)
- 1 week -> create design and chip choice on paper
- 2 weeks -> hardware build
- 1 week -> machine language(s) design
- 2-3 weeks -> LLVM integration (hopefully!)

Other

- Ethical clearance? → No
- Inspiration:
 - [8-Bit Breadboard Computer by Ben Eater](#)
 - [1 Instruction CPU by Garry Explains](#)
 - [Writing an LLVM backend](#)

Current 8-BIT Breadboard Computer
Architecture Diagram



as seen on Ben Eater's Youtube Channel:
<https://www.youtube.com/channel/UCS0N5baNIQWJCUrhCEo8WIA>

Proposed architecture changes a part of the BSc project

