



Senior Design — SDMAY24-14
Periodic Report 2-03

i281/e Hardware Implementation

Reporting Period: February 10th through February 24th

Project Personnel

Dr. Alexander Stoytchev (Advisor/Client)	Daryl Damman
Logan Lee	Grant Nordling
Braxton Rokos	Gavin Tersteeg

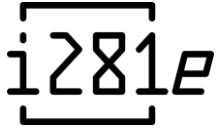
Progress Summary

During this period, we started to test the entire breadboard design together with all the modules and a few extended features such as the UART, compact flash, USB-C, and connection to a Terminal. We debugged the design for countless hours. Our client and ETG contact saw our design and became more excited about the future. We also updated most of our PCB designs and started working on a few new modules. We have also created a few new standards for the PCB designs thus PCBs will have a similar format and look.

Going forward, several objectives must be met at critical times to ensure the project does not slip behind schedule. Once PCB designs are ordered, documentation and testing will be prioritized alongside cleaning up loose ends.

Decisions Made

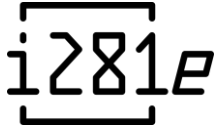
- ALU PCB version needs both the standard design and the updated logic with NOR operation.
- Standard for locations of ports to edges of PCB.



Accomplishments

Individual

- Daryl Damman:
 - Water jetted PCB polycarbonate boards.
 - Updated Register File PCB layout and schematic.
 - Create i281/e Minutes time-recording system to semi-automatically track time spent on the project between members.
 - Initiated backing board for PCB design.
- Logan Lee:
 - Created the CMEM PCB Design.
- Grant Nordling:
 - Updated the Control Table size and layout.
 - Made new part order and contacted ETG to get new parts
- Braxton Rokos:
 - Created a separate PCB for the ALU without the NOR functionality.
 - Finalized ALU PCB designs except for routing.
- Gavin Tersteeg:
 - Debugged the breadboard design and got the terminal to work with the design.
 - Started initial design of the User Panel and DMEM PCB.
 - Implemented Bypass Filters on all boards in the breadboard design to achieve 1 MHz.
 - Implemented DOS/281 utilities such as XMODEM and HDUMP

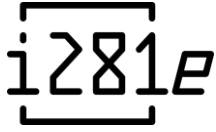


Team

- Tested the Breadboard design in its entirety.
- Continued work on creating PCBs for the final product and ensuring that they will interoperate with each other.

Individual contributions

Name	Individual Contributions (<i>Short List</i>)	Weekly Hours	Cumulative Hours (Starting from Biweekly 2)
Daryl Damman	Register File PCB & Management	14.5	59.5
Logan Lee	CMEM PCB	15	35
Grant Nordling	Control Table PCB & Part Order	7	14
Braxton Rokos	ALU PCBs, Meeting Notes	12	39
Gavin Tersteeg	DMEM and User Panel PCB, Breadboard Design Debugging	25.25	55.25



Broader Context

Identification of New Effects

As mentioned in section 4.4 of our design document, the primary effect that our project is educational. The ultimate purpose of the i281 CPU is to be used as a teaching tool to better educate ECpE students on digital logic and computing basics. As we continue to work through the design and implementation process, we have been able to identify new effects that our project may have on students.

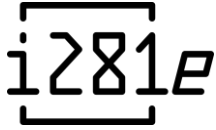
Originally, the primary goal of our project was to teach CPU architectural basics. Through the experience of our own implementation work, we have found that it can be useful for teaching other related subjects. As the i281 CPU is built out of discrete logic chips, the electrical characteristics of these parts must be considered alongside the purely functional. A student working with the i281 platform would get to learn about how digital logic and basic electrical engineering intersect to create useful products.

Evidence Demonstration of Positive Effects

Through a classroom setting, the i281/e CPU can be used to teach electrical design, computer architecture, and assembly software design in a more refined detail than shown in any pre-existing class at Iowa State. The processor itself has been demonstrated to show a large range of capabilities to ETG @ IASTATE and our advisor/client.

Justification of Negative Effectives

The i281/e CPU project can be costly to manufacture and implement. Throughout our design process, we have ensured that the overall design and implementation are robust and can withstand a reasonable time. Measures have been taken to mitigate the cost of PCBs, components, and assembly. Lastly, all implementations are or will be heavily documented to ensure future reuse and ease of repairability.

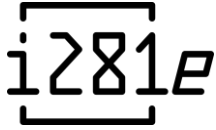


Upcoming Actions

- Daryl Damman:
 - Finalize Register File PCB Design.
 - Produce style sheet for documentation.
 - Organize materials for Midterm Peer Review.
- Logan Lee:
 - Make updates to the CMEM PCB.
 - Finalize the design of the Program Counter PCB.
- Grant Nordling:
 - Finalize Control Table PCB Design.
- Braxton Rokos:
 - Finalize ALU PCB Design.
- Gavin Tersteeg:
 - Finalize DMEM and User Panel PCB Design.

Plans for the Next Reporting Period

- Finalize the PCB layout (Due Feb. 26th)
- Complete PCB Routing (By Mar. 1st)
- (By Mar. 1st/Mar. 4th)
 - Order PCBs to be printed.
 - Have official cost per board for parts.
- Update documentation after all the PCBs are ordered.



Meeting Notes

Feb 12:

- We showed the breadboard version of the CPU to the client and Matt from ETG in its entirety.
- We talked over some of the PCB ideas, like how to label different things on the silkscreen.
- We tinkered around with the UART and the terminal.
- We decided to build a PCB version of the ALU without our new NOR functionality.

Feb 16:

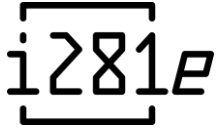
- Standardized connector to edge measurements on PCB to 150mil.
- Worked on adding the compact flash (CF) onto the breadboard and PCB designs
- Decided to use the CF horizontally on the PCB design.
- Tinkered with our control table layout

Feb 19:

- Showed off design
- Goals to update silkscreen labeling
- Potentially purchase terminal and keyboard for the class
- Need to find new power supply idea
- Hope to have PCB complete for ordering by March 1st ish
 - Need to have order out by spring break
- Control lines need their names
- LED Labeling
- Next meeting plan is to attempt the backboard/motherboard

Feb 23:

- Reviewed the actual sizing of the PCB's and their locations on the backboard/motherboard



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- Update on schedule, goals, and tasks
- Need to generate BOMs for each board
- New part order