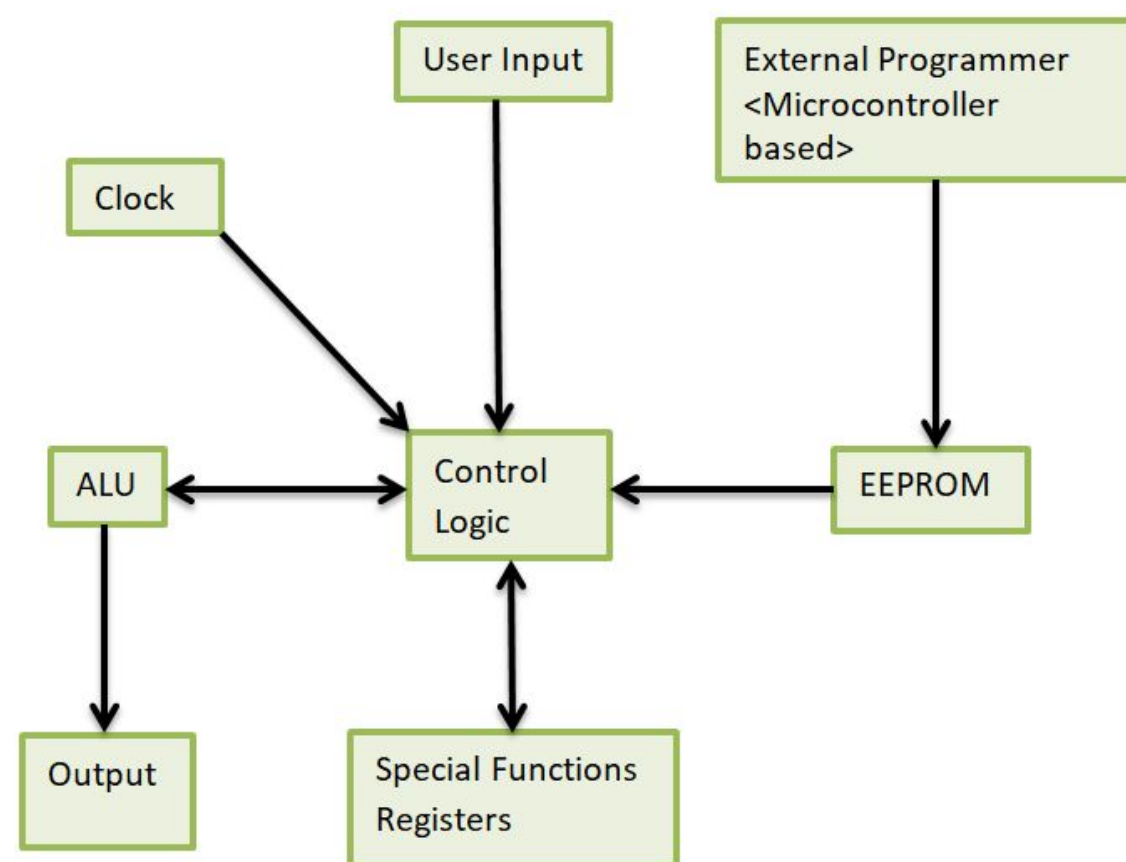


Project Description

We are creating an 8-bit CPU kit to teach the fundamentals of computer architecture to high school level students and hobbyists. This will be achieved by making a product that takes the traditional cpu and breaks it up into its individual components, making it easier to understand what each piece does. Our product will be made up of the four main components of a CPU. These components being the ALU, control logic, EEPROM, and special function registers.

Block Diagram of CPU



Key: direction of arrows indicate the direction of data flow

Motivation

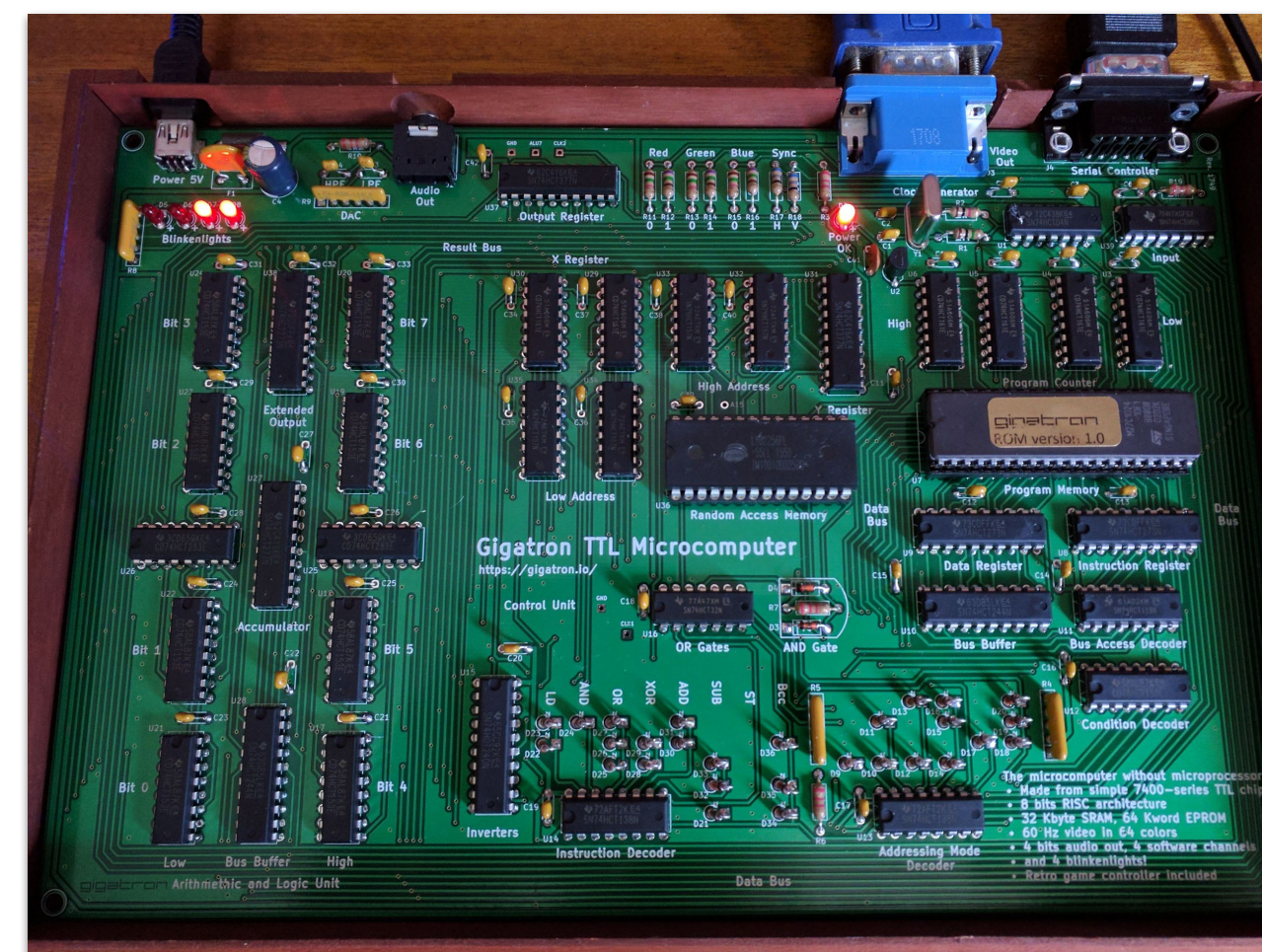
Motivation for this product came from the lack of easy to understand courses about basic computer architecture. Currently there are no easily accessible 8-bit CPU kits on the market that come with a curriculum to learn from. The most important aspect is that our product is to be simple, but still have enough content for users to use and learn from. This product can't just be another tool that users just quickly complete and lose interest in. Our goal is to keep them engaged and wanting to dive deeper into what computer architecture is.

Existing Products and Solutions

There are products that are similar in the sense that they explain how to put together an 8-bit computer. These products generally don't sell an actual kit to use in building, just a list of components. Or they give a premade board and just give commands that can be used to program it.

One such product is the Kano Computer Kit. It provides a set of parts and instructions using a Raspberry Pi 3 and their own OS. The Kano Computer Kit is focused on plugging in peripherals into an already built CPU instead of teaching how basic architecture interact with each other. It is also focused towards teaching children how to code.

A similar product is from Gigatron TTL which provides a kit to build a transistor level computer. The kit can be bought to assemble to play games on.[4] This however, does not show others how each component works or communicate with other components.



Gigatron Computer [1]

Value Proposition

Our project will give students and hobbyists an easy way to learn basic computer architecture with a focus on the CPU. The focus will be on making this knowledge more accessible and easy to use and understand. This will give an opportunity for students and hobbyists to get a headstart if looking to move towards a field dealing with computer architecture. Our product will focus on the actual architecture instead of just dealing with peripherals.

Product Benefits:

- Easy to understand
- Greater accessibility than other products
- Does not require additional software to operate
- Adaptable curriculum

(PCINT14/RESET) PC6	1	28	PC5 (ADC5/SCL/PCINT13)
(PCINT16/RXD) PD0	2	27	PC4 (ADC4/SDA/PCINT12)
(PCINT17/TXD) PD1	3	26	PC3 (ADC3/PCINT11)
(PCINT18/INT0) PD2	4	25	PC2 (ADC2/PCINT10)
(PCINT19/OC2B/INT1) PD3	5	24	PC1 (ADC1/PCINT9)
(PCINT20/XCK/T0) PD4	6	23	PC0 (ADC0/PCINT8)
VCC	7	22	GND
GND	8	21	AREF
(PCINT6/XTAL1/TOSC1) PB6	9	20	AVCC
(PCINT7/XTAL2/TOSC2) PB7	10	19	PB5 (SCK/PCINT5)
(PCINT21/OC0B/T1) PD5	11	18	PB4 (MISO/PCINT4)
(PCINT22/OC0A/AIN0) PD6	12	17	PB3 (MOSI/OC2A/PCINT3)
(PCINT23/AIN1) PD7	13	16	PB2 (SS/OC1B/PCINT2)
(PCINT0/CLKO/ICP1) PB0	14	15	PB1 (OC1A/PCINT1)

8-Bit Microcontroller [2]

Global And Societal Impacts

Our 8-bit CPU kit will allow students and hobbyists of younger ages to get an early grasp of computer architecture before pursuing further education into it. By introducing students to the basics of computer architecture early, it will provide them a good foundation for the classes they will take in college.

Team

Our team is comprised of many talented individuals. We have the experience and knowledge to build the appropriate circuits and program them efficiently.

Eric Walter - Electrical Engineer

Tyler Tetens - Computer Engineer

Justin Merila - Computer Engineer

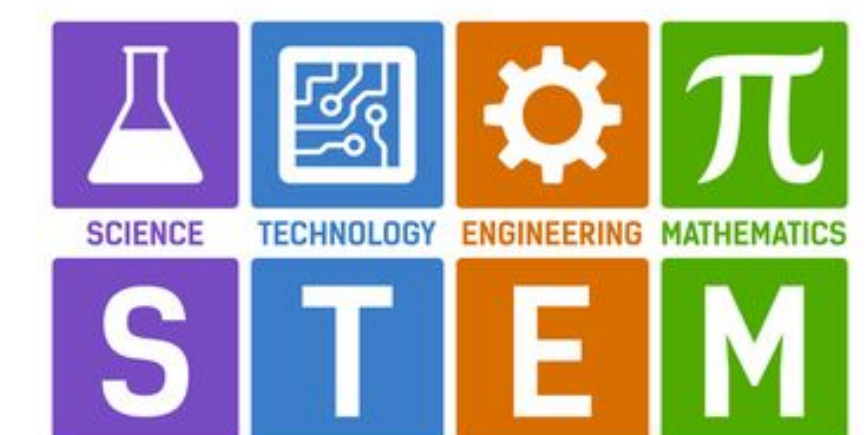
Jeremy Ho - Computer Engineer

Acknowledgements

We would like to thank Dr. Stanley for advising us on our project.

References:

- [1]<https://projects.drogon.net/gigatron/>
- [2]<https://protostack.com.au/atmega328>
- [3]https://www.nsf.gov/news/news_summ.jsp?cntn_id=295999
- [4]<https://gigatron.io>



STEM [3]