



On



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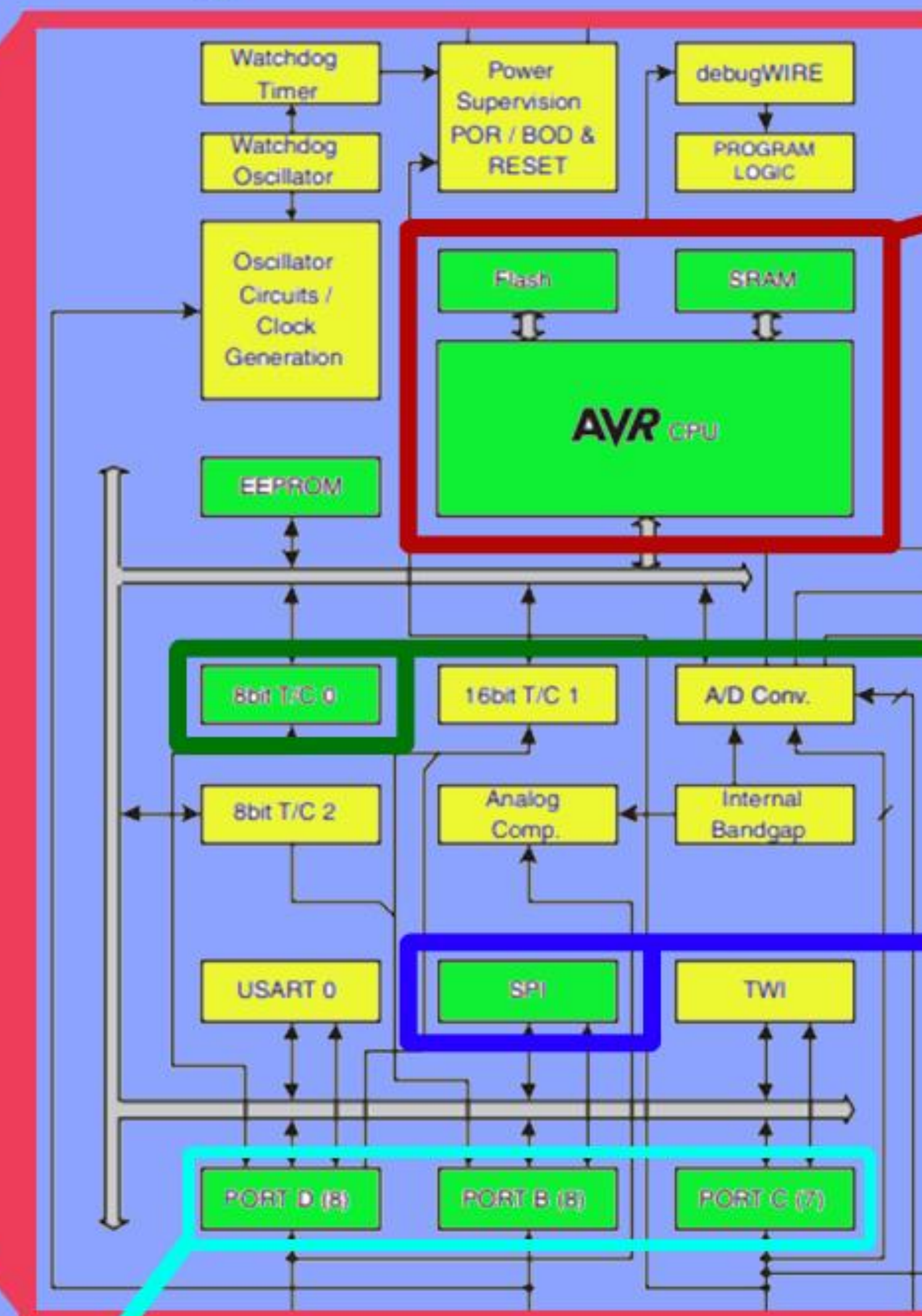
Advised by:
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Arduino is an open-source platform for building electronics projects. An Arduino can be programmed to input and output from a sensor or button to a motor or an LED. It could also be used to communicate with other devices via communication protocols.

The heart of an Arduino is the ATmega328P processor, which hosts many modules to assist the microcontroller.

ATmega328P Processor



Already Implemented
Not Yet Implemented

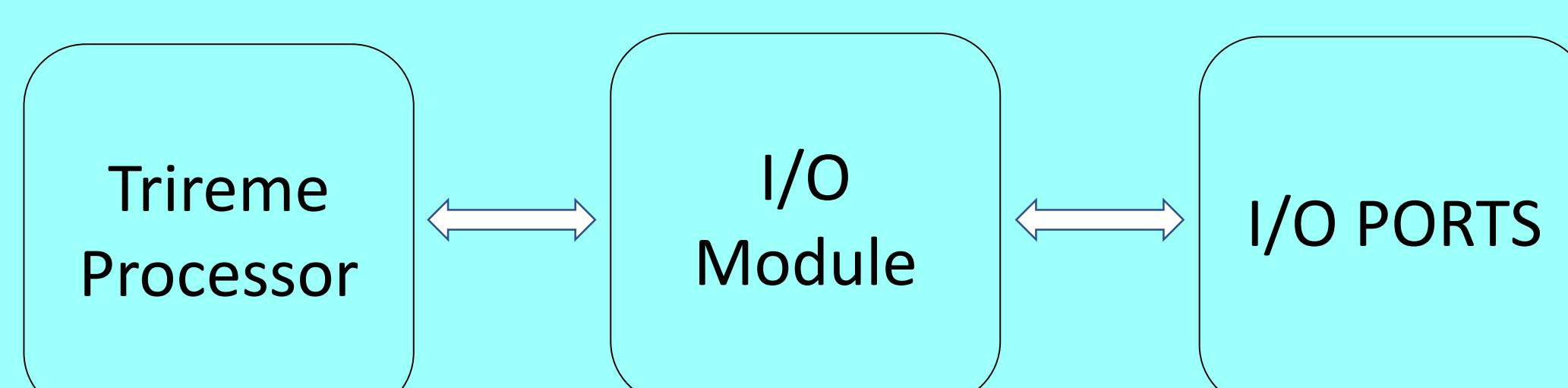
Find out more
about our project
on our GitHub:



Sources:
Bandara, S., Ehret, A., Kava, D., and Kinsy, M. A., "BRISC-V: An Open-Source Architecture Design Space Exploration Toolbox", 2019.

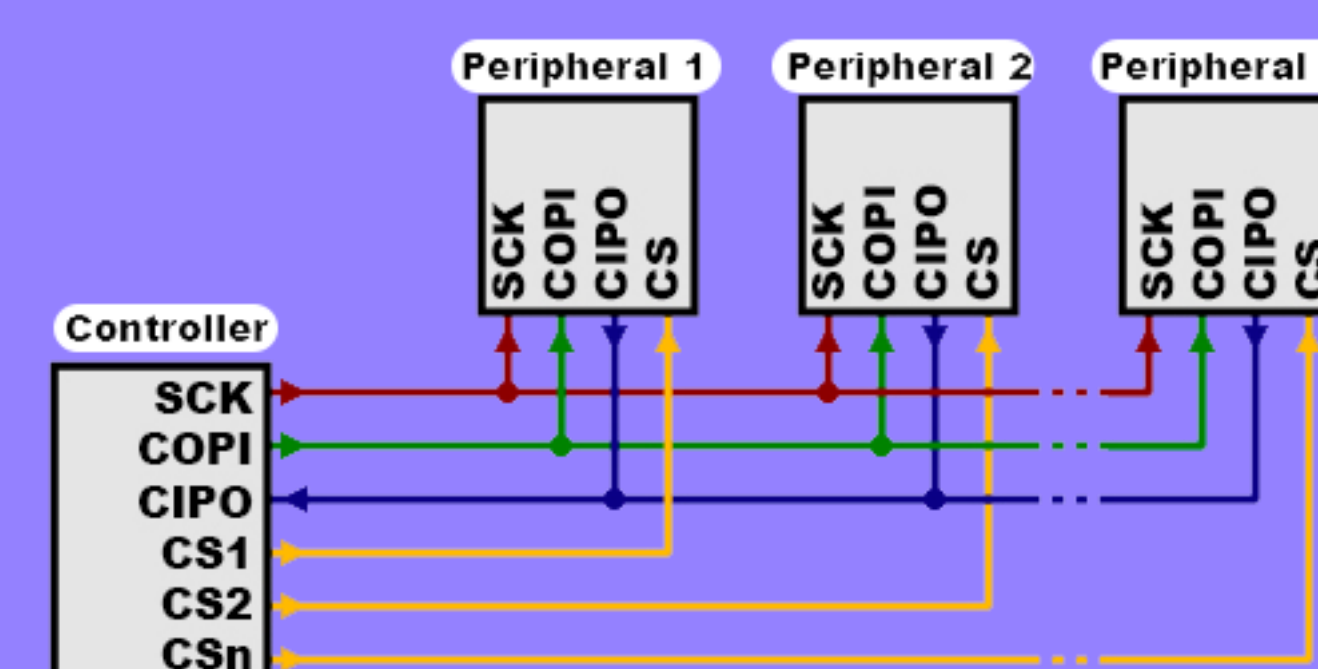
I/O Module

An important aspect of the Arduino is to be able to interface with external components. To do this on our design, we had to build our own I/O module. To write to I/O, a "store word" instruction is called to a specific address, which we catch and route to registers connected to GPIO.



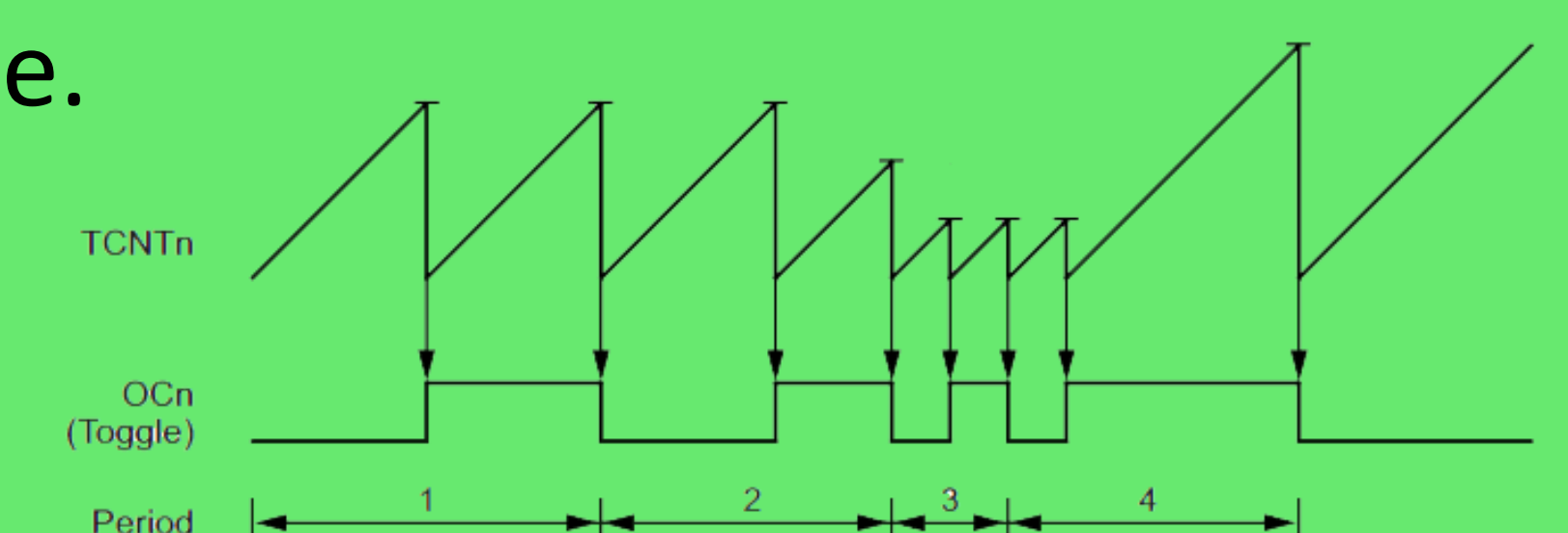
SPI Protocol

The SPI allows high-speed data transfer between devices. Serial devices communicate in full duplex parent-child mode which means two devices transmit and receive data synchronously.



Hardware Timer

As a part of our design, a timer/counter was created that mimicked the timers present on an actual Arduino. The timer implemented has 8 bits, and it has 6 modes. Timers on Arduino are most often used for Pulse Width Modulation, which will turn an output signal on for a variable percentage of time called the Duty Cycle.



Replicating a Processor

Our project set out to implement many of the functionalities of Arduino using a RISC-V processor rather than the ARM based AVR CPU normally found on Arduino. Trireme, an open-source RISC-V soft processor was our core that replaced the AVR CPU, and each additional hardware module found in the ATmega328P had to be created by hand. Additionally, a whole new toolflow had to be used to compile and load code written for Arduino into our RISC-V processor. Our design is mapped to and runs on the DE2-115 FPGA.

