

CSF Programming Projects

(CSF Lab 600.334)

Objective:

- Gain a deeper understanding of the functional units of the MIPS architecture by taking advantage of advanced features of the instruction set.
- Develop an intuitive understanding on what low-level processes are involved whenever high-end applications are used or programmed.
- Develop experience in the field of embedded systems and the challenges and tradeoffs necessary to have working actual hardware systems.
- Understanding fundamentals of computer interfacing as well as appreciate the challenges of real time computing

Note: Some topics are optional because the instructors are open to students' personal projects.

1.	Introduction to SPIM	<ul style="list-style-type: none"> • CSF foundational topic
2.	Tracking and debugging	<ul style="list-style-type: none"> • CSF foundational topic
3.	Bit manipulation & Data representation	<ul style="list-style-type: none"> • Bitwise operations (AND, OR, NOT, XOR, shift) • Bitmapped images • Strings of characters • Using memory to store data
4.	Procedures & Subroutines	<ul style="list-style-type: none"> • Stack (CSF foundational topic) • Sorting (iterative)
5.	Recursion	<ul style="list-style-type: none"> • Basic recursion (CSF foundational topic) • Ackerman • Quick sort
6.	Arithmetic operations	<ul style="list-style-type: none"> • BCD arithmetic • Booth's algorithm • Division • Unlimited precision arithmetic
7.	Special topics	<ul style="list-style-type: none"> • Floating point in MIPS • Pipelining • Matrix operations • Benchmarking • Floating point library with integer registers
8.	Exceptions	<ul style="list-style-type: none"> • Exception handler
9.	Introduction to AVR ("Lights")	<ul style="list-style-type: none"> • CSF foundational topic
10.	USBkey: "Blinky"	<ul style="list-style-type: none"> • CSF foundational topic
11.	USBkey: "Counter"	<ul style="list-style-type: none"> • Debouncing • Number representation • Boundary handling
12.	USBkey: Number checking	<ul style="list-style-type: none"> • Primality • Parity • Odd • Even
13.	USBkey: Checksum	<ul style="list-style-type: none"> • Luhn's algorithm
14.	USBkey: Interfacing	<ul style="list-style-type: none"> • Eight LEDs (direct connection) • 7-Segment display (direct connection) • BCD to 7-segments driver • 2 7-segments displays: with 2 registers or multiplexed.
15.	USBkey: Timers	<ul style="list-style-type: none"> • Pulse Width Modulation