AVR Simulation Using SimulIDE



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Preface

SimulIDE is a free and open source simulator which can be used to simulate AVR and PIC microcontrollers and Arduino boards.

In the step-by-step tutorial, you will learn to download *Simulide* and simulate a simple circuit in the Simulide. Then, you write a program in Atmel Studio (or Microchip Studio) and simulate it in *Simulide*.

Dedication

The step-by-step tutorial is dedicated to the memory of Vahid Mokhtari who sacrificed himself to serve humanity and make a better world and passed away a few days ago in Tehran.

Downloading SimulIDE

- 1. To download the latest version of SimulIDE, go to <u>Simulide.com</u> and click on Downloads.
- 2. Click on *Windows 64* (or any other choice depending on your operating system). A zip file will be downloaded to your computer.



 Unzip the downloaded file. (If you don't know where the file is downloaded, go to *My Computer* and click on *Downloads*. The downloaded file is most probably here. Double click on the *SimulIDE_0.4.14-SR4_Win64* file. The compressed file contains a directory. To unzip, drag the directory to your desktop.)



Opening SimulIDE

4. Open the decompressed directory. Click on the *bin* directory. Then, click on the *simulide* file to open it.

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- 5. SimulIDE has 3 parts:
 - a. the left part contains some components which can be used in circuits.
 - b. In the center part, you can draw circuits.
 - c. The right part can be used to edit source codes.



- 6. Draw the following circuit. To do so:
 - a. Drag the *Rail* component and drop onto the Drawing Part. (Put the mouse pointer on the *Rail*. Press the left button of mouse and while the button is down, move the mouse to the Drawing Part. Then, release the mouse button.)
 - b. Drag a *Switch* component.
 - c. Drag a *Resistor*.
 - d. Drag and drop a *Ground (OV)*.



e. Drag an *LED* and drop to the proper location. Then, to rotate the LED, right click on the LED and choose rotate CW (clockwise).



Changing the Properties

The resistor is 100Ω . But we need a 270Ω resistor. To access the properties of the resistor, right click on the resistor and choose Properties.



7. Double click on resistance. Then, type 270 and press Enter. Close the Properties.

-	Resistor-3	×
Na	ime	Value
4	Resistor-3	
	itemtype	Resistor
	id	Resistor-3
	Show id	false
	Resistance	100
	Unit	Ω
	Show res	true
Re	sistor:	

Wiring

- 8. To connect Ground to the LED, move the mouse to the top of Ground. The shape of the mouse pointer changes to cross. Now, click with the left button of mouse on top of the Ground. Then, move the mouse cursor to the cathode pin of LED and click on it. A wire should be added between the Ground and the LED.
- 9. Similarly, connect the other components together, as shown below.



Simulating

10. To run the simulator, press the Power button.



11. Now, press the gray button below the switch. When the switch is closed, the LED is ON. Otherwise, it is OFF.



Saving the simulation

12. To save the circuit, press Ctrl + S or click on the save icon.



Writing a toggle program

13. In Atmel Studio (or Microchip Studio) make a new project and write the following Assembly or C program. Choose ATmega328 as the chip.

С	Assembly
<pre>#include <avr io.h=""> #define F_CPU 1600000UL #include <util delay.h=""> int main(void) { DDRB = (1<<5); while (1) { PORTB ^= (1<<5); } }</util></avr></pre>	LDI R16, HIGH(RAMEND) OUT SPH, R16 LDI R16, LOW(RAMEND) OUT SPL, R16 SBI DDRB, 5 L3: SBI PORTB,5 CALL DELAY CBI PORTB,5
_delay_ms(500); }	CALL DELAY RJMP L3
}	
	DELAY: LDI R20, 64 D0: LDI R21, 200 D1: LDI R22, 250 D2: NOP DEC R22 BRNE D2 DEC R21 BRNE D1 DEC R20 BRNE D0 RET

- 14. Press F7 to build the hex file.
- 15. Open Simulide.
- 16. Drag and drop an Arduino UNO board from the Component list.



17. Right click on the Arduino board and choose *Load Firmware*. Then, choose the hex file which you made in Atmel Studio.

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18. Press the Power Button to run the simulator. The LED of the Arduino board begins blinking. The LED is connected to pin 13 of Arduino (PB5 of ATmega328). You can also

connect an LED together with a 270-ohm resistor to pin 13 of Arduino. In the case, the LED also blinks.



Monitoring Registers

- 19. You can monitor the values of I/O registers. To do so, right click on the Arduino board and choose Open RamTable.
- 20. Double click on a cell below the *Reg.* column and type PORTB and press Enter. The value of PORTB changes between 0 and 32, while the LED blinks.



Some Notes

 If you change the source code, you need to reload the firmware to run the new code in SimulIDE. To do so, press the Power button to stop simulation. Then, right click on the Arduino (or the microcontroller) and choose *Reload firmware*.

	1	Arduino Uno-1		
	•	AS		
2 3 PWM	₽	Main Mcu Load firmware		
5 PWM	C E	Reload firmware		
7	ċ	Save EEPROM data		
8 9 PWM 10 PWM 11 PWM 12	모 모 모	Open RamTable. Open Serial Monitor. Open Serial Port.		
13 GND Aref	© × ⊗	Copy Remove Properties	Ctrl+C Del	
	やぐひ	Rotate CW Rotate CCW Rotate 180		
	⇔ ≎	Horizontal Flip Vertical Flip		
	T			

2. When you open your simulation file in the simulIDE, don't forget to load the firmware! SimulIDE does not save the firmware.