

## **NIELIT, Gorakhpur**

**Course Name: A-level (1<sup>st</sup> Sem.)**

**Subject: IoT**

**Topic: Developing Bootloader for Arduino cont.    Date: 27.04.2020**

### **How arduino is programmed with its IDE**

Arduino bootloader uses the serial protocol (UART) to download the program hex file from PC/laptop. At the PC/laptop side Arduino IDE is running which compiles the application program and sends its compiled hex code to the Arduino board over USB cable serially.

Arduino IDE uses the avrdude tool which is used to upload/download the code/data content to/from the ROM/EEPROM of AVR microcontrollers.

AVRDUDE (AVR Downloader Uploader) is a program for downloading and uploading the on-chip memories of Atmel's AVR microcontrollers. It can program the Flash and EEPROM, and supported by the serial programming protocol, it can also program fuse and lock bits.

The communication protocol from STK500 is used by avrdude to upload compiled hex file to arduino serially. This is the reason for why we include/use STK500 commands header file in bootloader program.

STK500 communication is used in between avrdude (running at pc/laptop side) and bootloader (running at arduino side) to write/read the hex file.

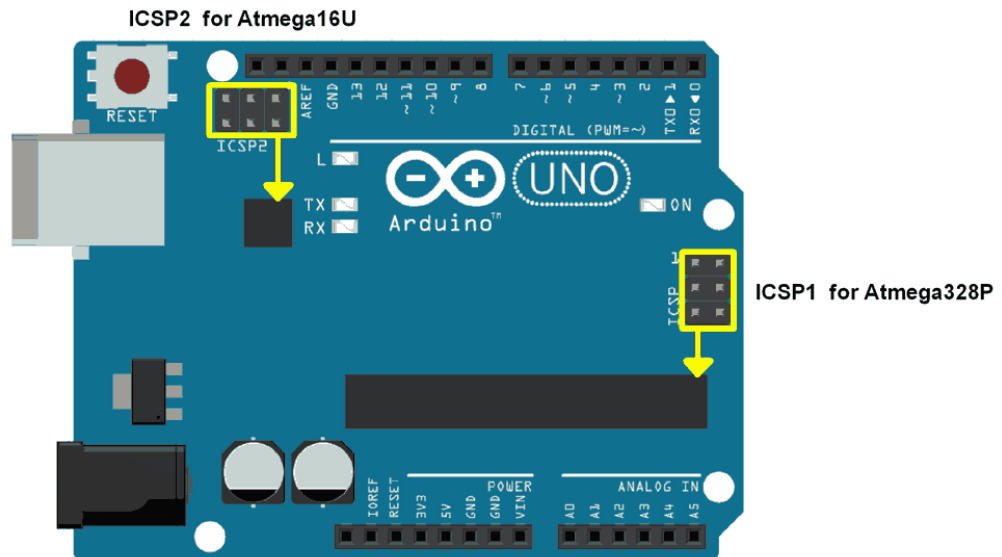
Now let's first see how to upload bootloader program in boot section.

### **How to upload Bootloader first**

To use bootloader, we need to first write/install bootloader into the bootloader section of program memory.

Generally, we program any IC before soldering it on PCB. Whereas many microcontroller manufacturers (e.g. Atmel, Microchip) provide specialized In System Programming (ISP) method known as In-Circuit Serial Programming (ICSP). In such methods ISP header is provided on board for flashing it with external programmer.

Arduino has on board ICSP header for programming as shown in below figure.

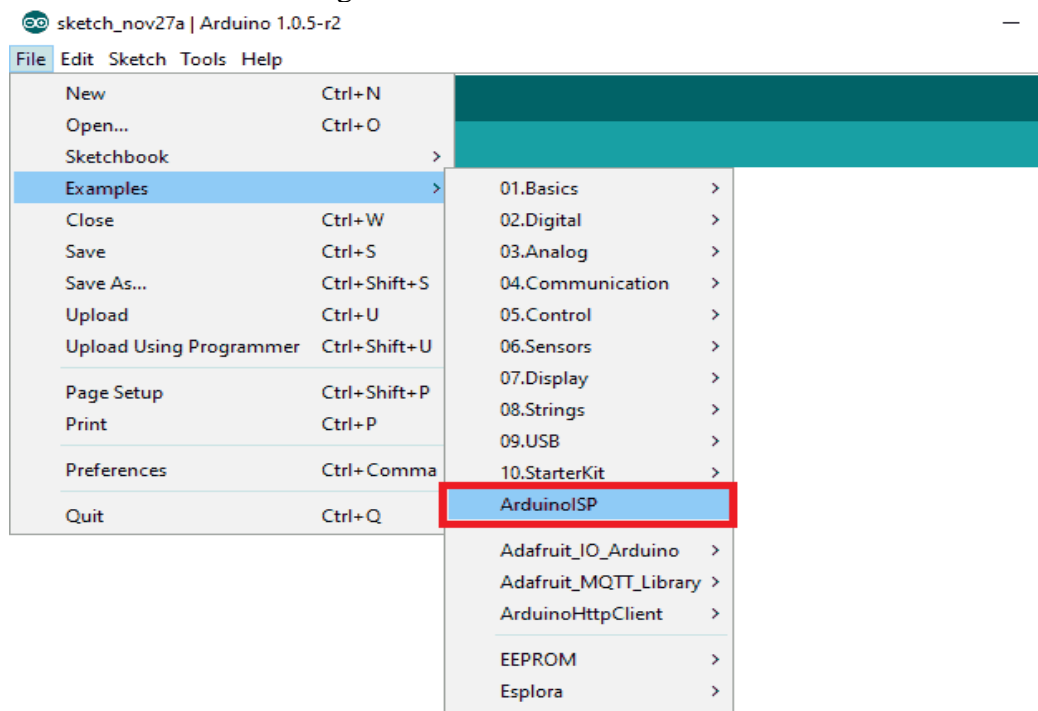


### Arduino ICSP Headers

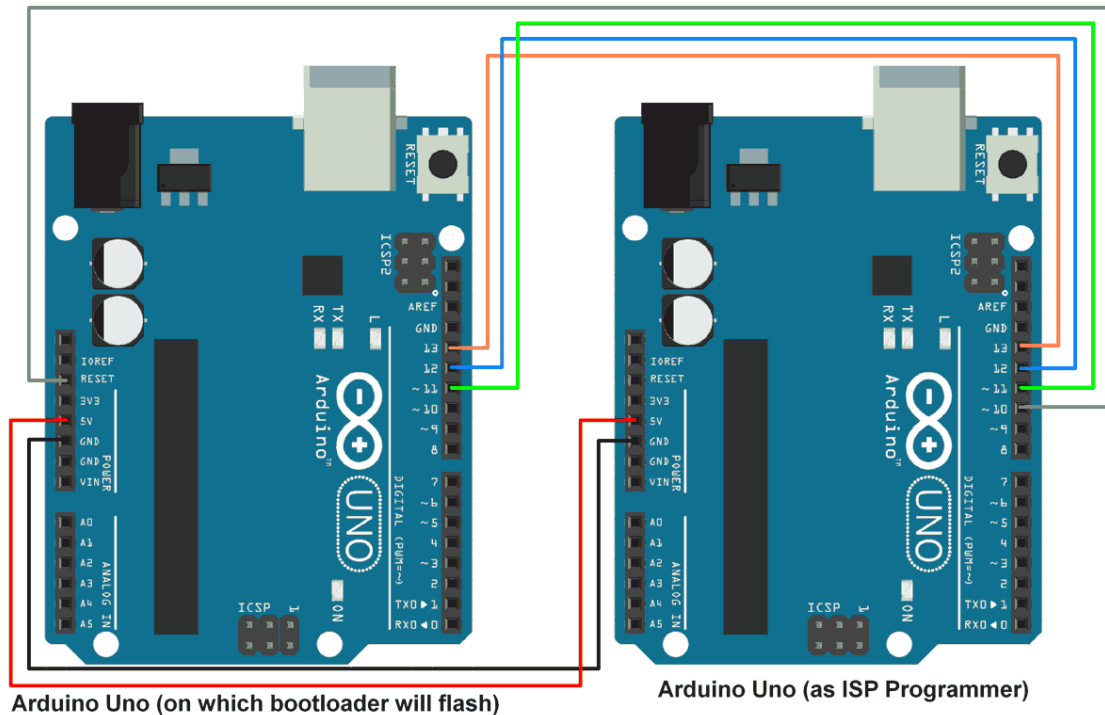
As shown in above figure Arduino UNO has two ICSP headers. One for the ATmega16U2 and one for the ATmega328. To flash the bootloader, we need to use ICSP header for the ATmega328.

We can build and flash arduino bootloader using Atmel Studio and USBasp (in circuit programmer).

Also, we can flash bootloader using another Arduino i.e. if we have second arduino board we can use it as ISP programmer. Open Arduino IDE and open ArduinoISP example from its example menu as shown in below figure.

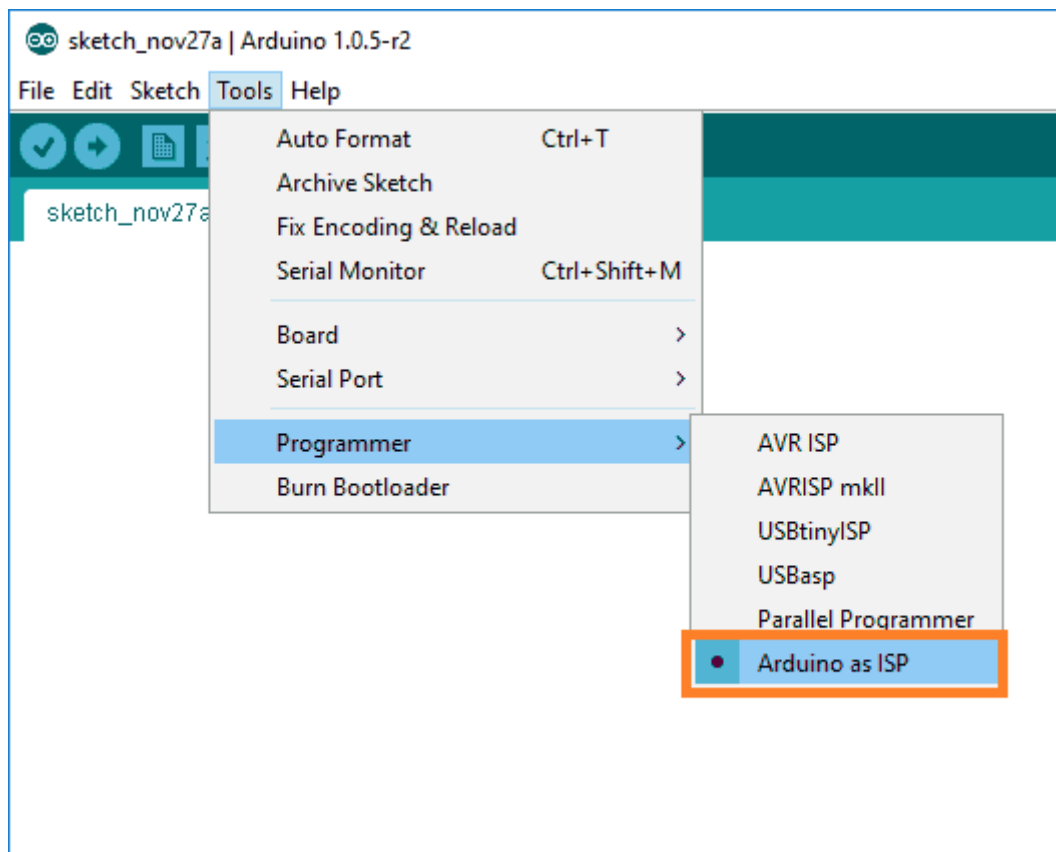


and upload ArduinoISP program on Arduino board which we are using as ISP Programmer. Now connect (as shown in below figure) this arduino isp programmer to arduino board which is to be programmed.



### Arduino as ISP

Select Arduino board (ISP programmer) on port and select programmer as “Arduino as ISP” from tools option as shown in below figure.



Next just click on “Burn Bootloader” option from tools menu (seen in above image). Wait for bootloader burning process completion. We can see the LED blinks while bootloader burning process is on.

On successfully burning of bootloader, Arduino board (on which bootloader is burned) is ready to be programmed.