

## Development of a Firmware Downloader for AVR Microcontrollers for Educational Purposes

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**Abstract :** This paper introduces the development of a firmware downloader for students attending microcontroller-related courses taught by the authors. In the courses, AVR microcontroller experiment kits are used for programming exercise and the AVR microcontroller is programmed through a serial communication interface using a bootloader preinstalled on it. To use the bootloader, a matching firmware downloader that runs on a host computer and communicates with the bootloader is also required. When firmware downloading is completed, the serial port used for it needs to be closed. If the downloaded firmware uses serial communication, the serial port needs to be reopened in a serial terminal. As a result, the programmer of the AVR board switches from the downloader program and the serial terminal and vice versa. It is a simple task but quite a hassle to do each time new firmware needs downloading. To provide a more convenient programming environment for the courses, the authors developed a downloader program that includes a serial terminal in it. The program operates in downloader or terminal mode and the mode switching is performed automatically; therefore manual mode switching is not necessary. The feature provides a more convenient development environment by eliminating the need for manual mode switching each time firmware downloading is required.

**Keywords :** bootloader, firmware downloader, microcontroller, serial communication

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