the nozzle of an actual FDM printer. The results show that the device can complete the cleaning in only 86 seconds. The cleaning time is greatly reduced without damaging the nozzle. The proposed cleaning device improves the efficiency and parts quality of FDM printers, and overcomes the defects of manual, mechanical and chemical cleaning methods. The control system of the device works stably, automatedly and conveniently, providing a guarantee for the effective and timely operation of FDM printers. To further bolster the precision, intelligence, universality and convenience of FDM printers, the future research will focus on transplanting and integrating the modules of our cleaning system to 3D printers and develop the online cleaning function for these printers. The research findings provide meaningful insights into the application and promotion of FDM 3D printers.

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