Supplementary Information

Portable Raspberry Pi-Based Spectrometer for On-Site Spectral Testing

Lin Zhu[1,2,3], Shuwei Yang[4,5], Zhibo Xiao[1,2,3], Huachuan Huang[6], Keding Yan[5], and Shouyu Wang[1,2,7,*]

[1]Jiangsu Province Engineering Research Center of Integrated Circuit Reliability Technology and Testing System, Wuxi University, Wuxi, Jiangsu, 214105 China

[2]OptiX+ Laboratory, School of Electronics and Information Engineering, Wuxi University, Wuxi, Jiangsu, 214105 China

[3]Computational Optics Laboratory, Jiangnan University, Wuxi, Jiangsu, 214122, China

[4]School of Intelligent Science and Information Engineering, Xi'an Peihua University, Xi'an, Shaanxi, 710125, China

[5]Advanced Institute of Micro-Nano Intelligent Sensing (AIMNIS), School of Electronic Information Engineering, Xi'an Technological University, Xi'an, Shaanxi, 710032, China

[6]School of Manufacture Science and Engineering, Key Laboratory of Testing Technology for Manufacturing Process, Ministry of Education, Southwest University of Science and Technology, Mianyang, Sichuan, 621010, China

[7]Single Molecule Nanobiology Laboratory (Sinmolab), Nanjing Agricultural University, Nanjing, Jiangsu, 210095, China

[*]E-mail: shouyu29@cwxu.edu.cn

1. Hardware Design

Figure S1 shows our designed portable Raspberry Pi-based spectrometer. Moreover, the mechanical designs of the light source tube, adapter, grating rotation frame, cylindrical lens and image recorder frame, and supporting plate are revealed in Figures S2-S6, respectively.

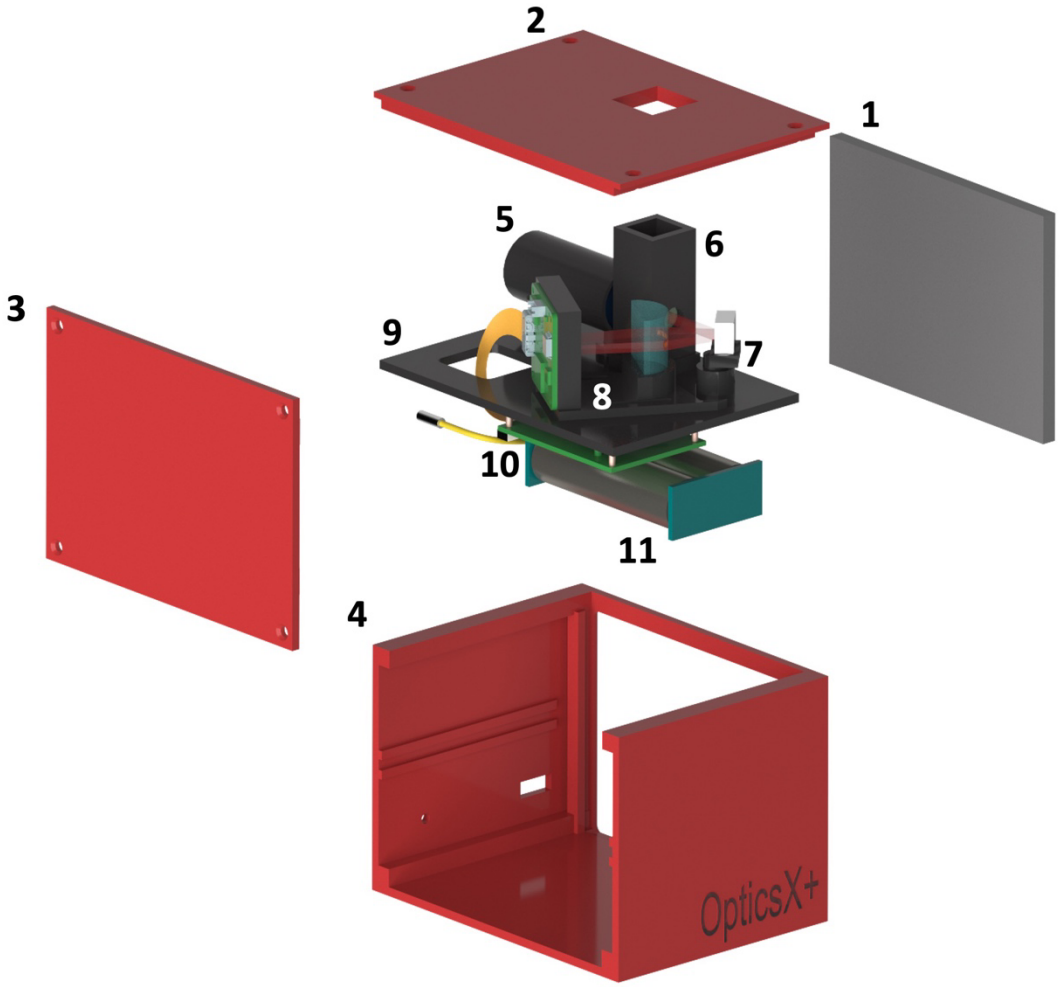

Figure S1. Hardware design. 1: Touch LCD, 2-4: Shells, 5: Light source tube, 6: Adapter, 7: Grating rotation frame, 8: Cylindrical lens and image recorder frame, 9: Supporting plate, 10: Raspberry Pi, and 11: Battery.

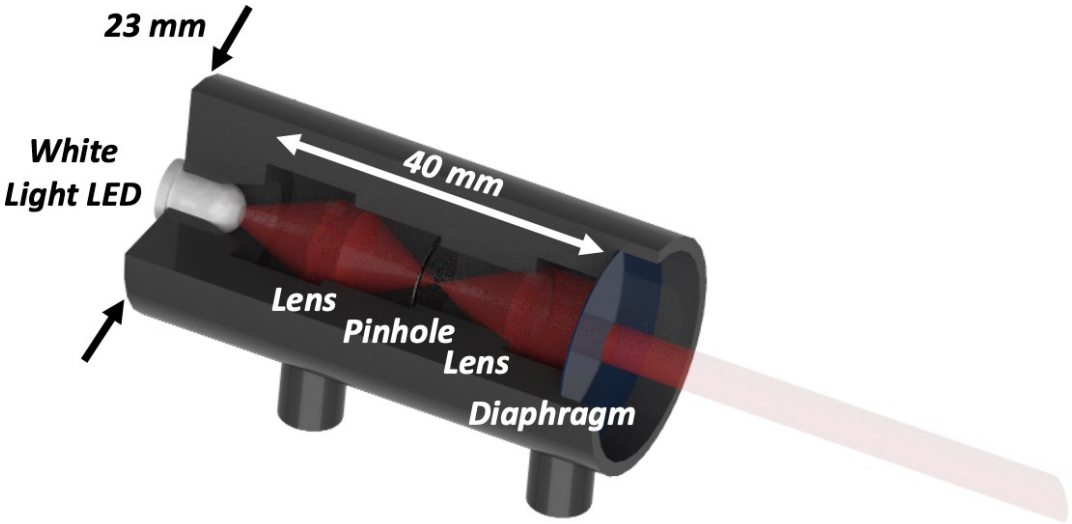

Figure S2. Light source tube.

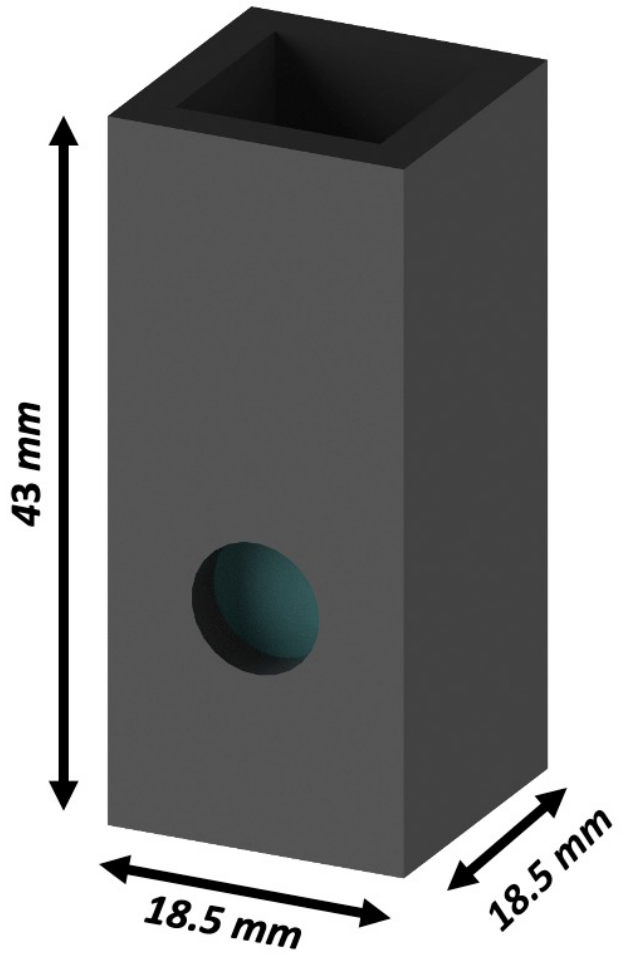

Figure S3. Adapter.

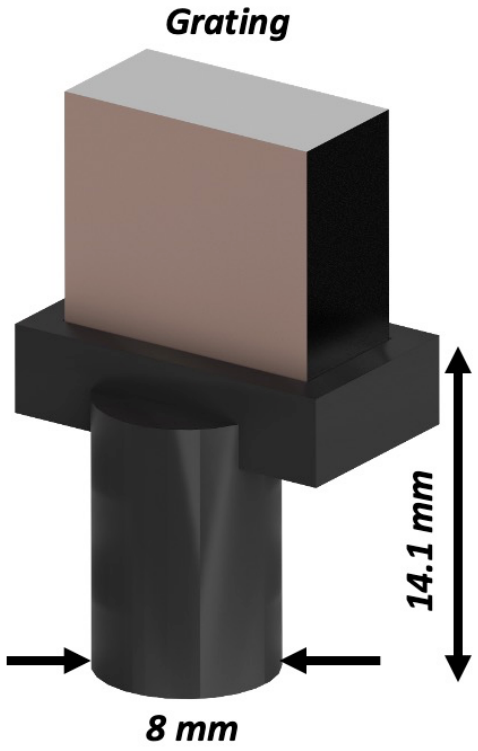

Figure S4. Grating rotation frame.

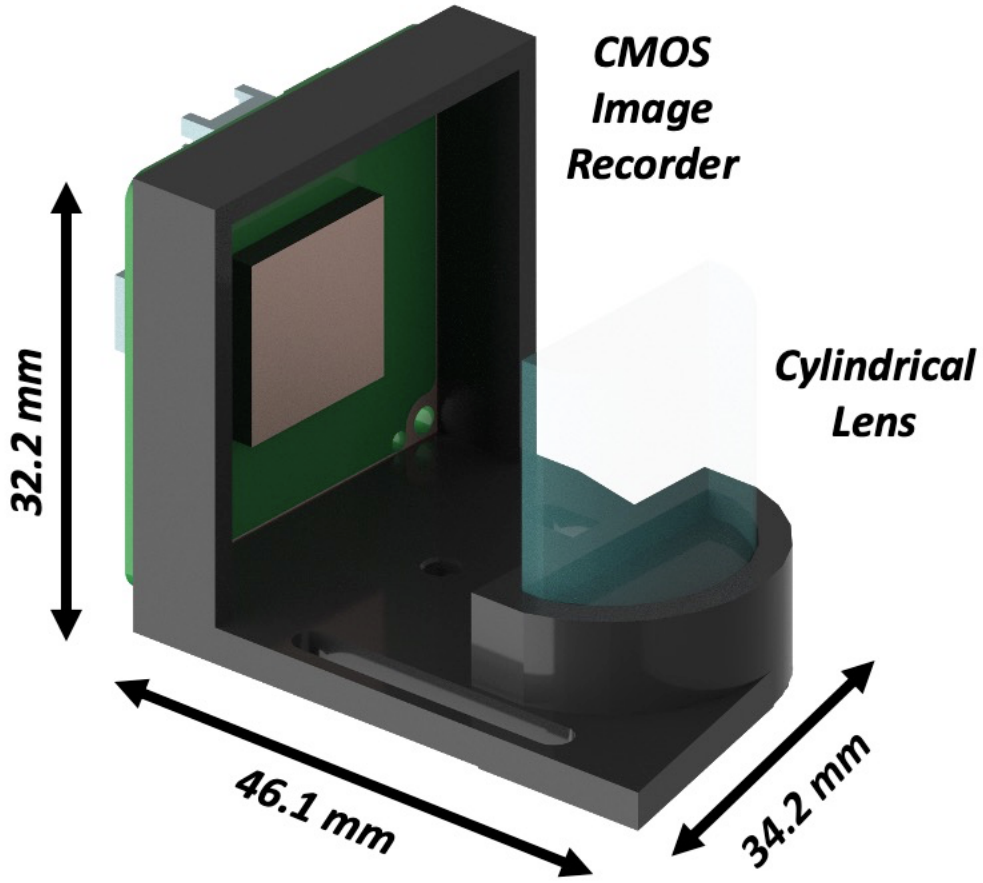

Figure S5. Cylindrical lens and image recorder frame.

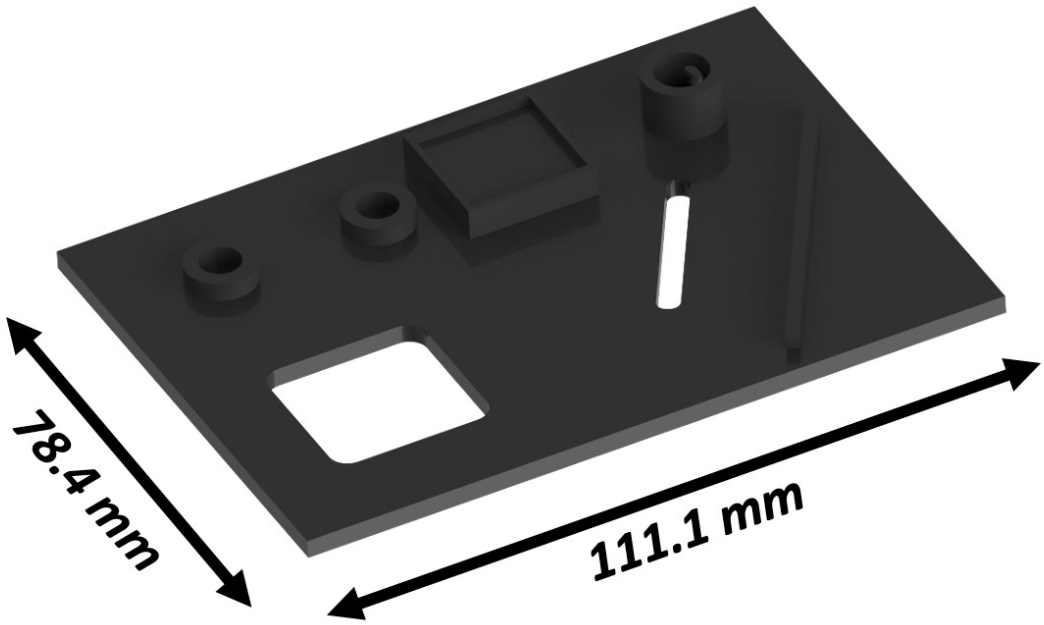

Figure S6. Supporting plate.

2. Software Design

The software for the portable Raspberry Pi-based spectrometer uses Python 3 and PyQt5 graphics libraries for interface design and Python OpenCV libraries for image processing. The software mainly includes the camera driver module, image display module, data processing module, result display module, and data storage module, as shown in Figure S7. Since the driver and Python application program interface of the used CMOS imaging chip (MVCB120-10UM-C, Hikrobot, China) have been provided, it is very convenient to develop software on the Raspberry Pi.

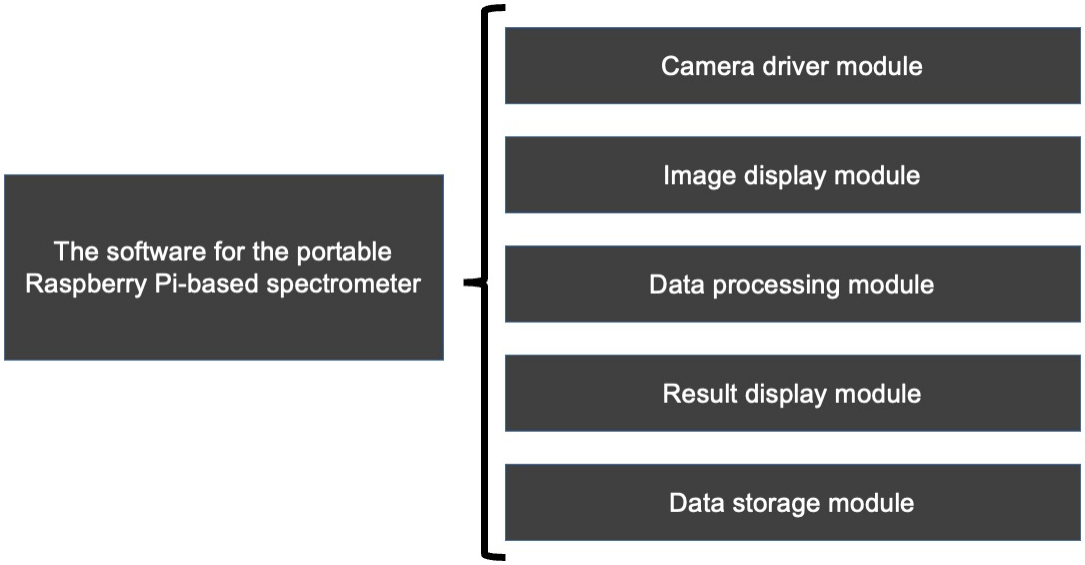

Figure S7. Software design.

Among them, the camera driver module mainly achieves the acquisition of the CMOS image recorder data and the adjustment of camera parameters. The image display module mainly displays the image (spectrum) obtained from the CMOS image recorder. The data processing module mainly

implements the image processing according to the algorithms in Figure 2. The result display module is based on the QCustomPlot library and displays the data as curves. The data storage module mainly saves the plotted curves and processed results.

In addition, the software has a main thread and a sub-thread. The main thread is used for user interaction and data display, while the sub-thread is used to obtain the image from the Python interface driven by the camera. At the same time, it implements a user interface for adjusting camera parameters, so that users can adjust the main thread.