Supporting Information

A portable microcontroller-enabled spectroscopy sensor module for the fluorometric detection of Cr(VI) and ascorbic acid, utilizing banana peel-derived carbon quantum dots as versatile nanoprobes

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Characterizations. The UV-Visible absorption spectrum was recorded by UV-Vis spectrophotometer instrument (Shimadzu UV 2600). Photoluminescence spectra were studied using a spectrofluorometer (Shimadzu, RF-6000) with light source i.e., xenon lamp. Time-resolved fluorescence measurements were carried by Deltaflex modular fluorescence lifetime spectrofluorometer (HORIBA Scientific) with a nano-LED pulse diode as excitation source at 340 nm. The morphology and size were observed through transmission electron microscopy (JEOL, JEM 2100 plus). Elemental composition was scrutinized using X-ray photoelectron spectroscopy (XPS) (PHI 5000 Versa Probe III). FT-IR spectrometer (Shimadzu IRTracer-100) were used to detect functional groups within a range of 400-4000 cm^{-1} with 100 numbers of scans. Monowave-300 microwave synthesis reactor (Anton Paar, USA) was used for the synthesis process.

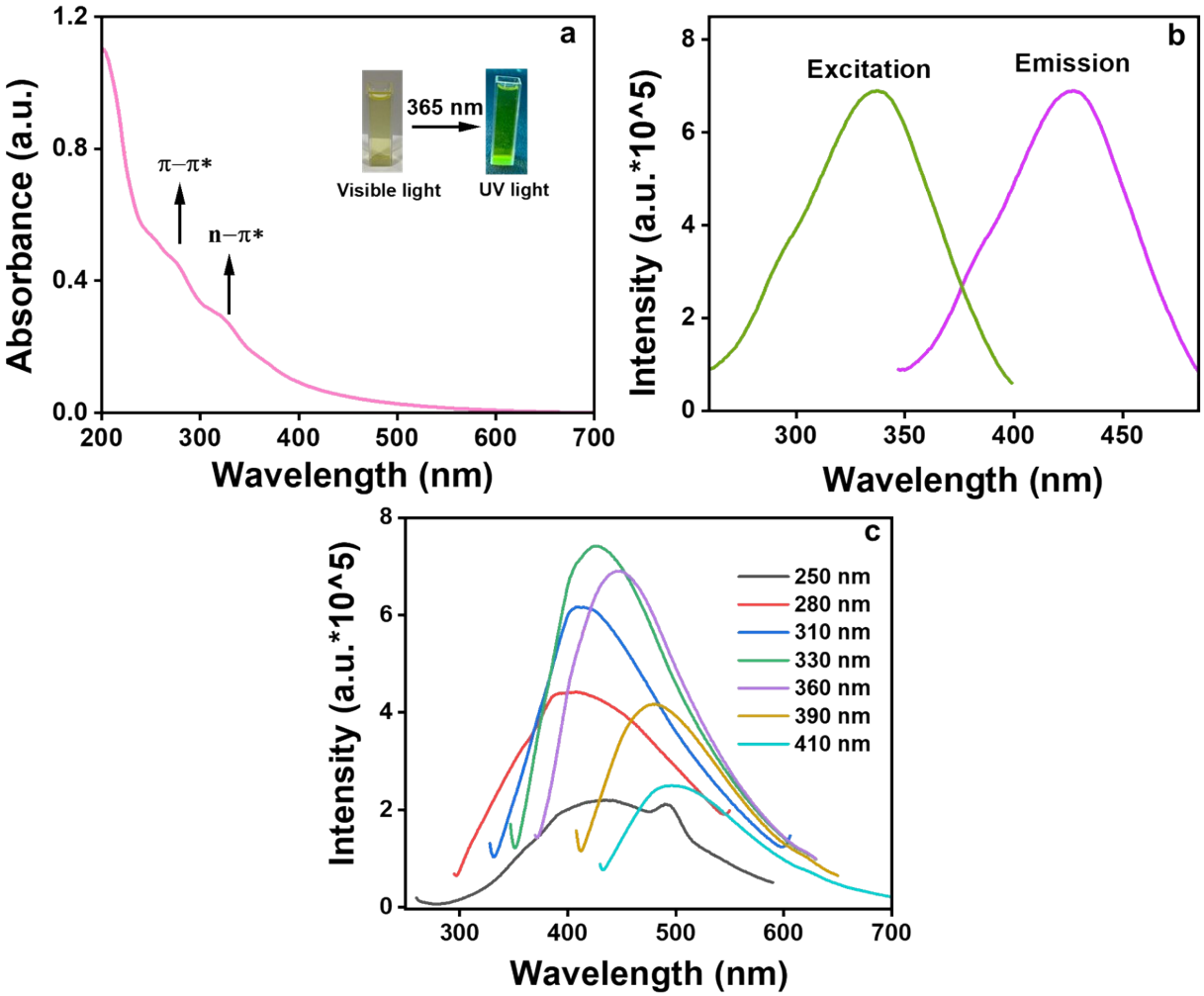

Figure S1. (a) UV-Visible absorption spectrum of BP-CQDs with inset image showing BP-CQDs under visible and UV light, (b) PL excitation and emission spectra of BP-CQDs and (c) PL emission spectra of BP-CQDs under various excitation wavelengths.

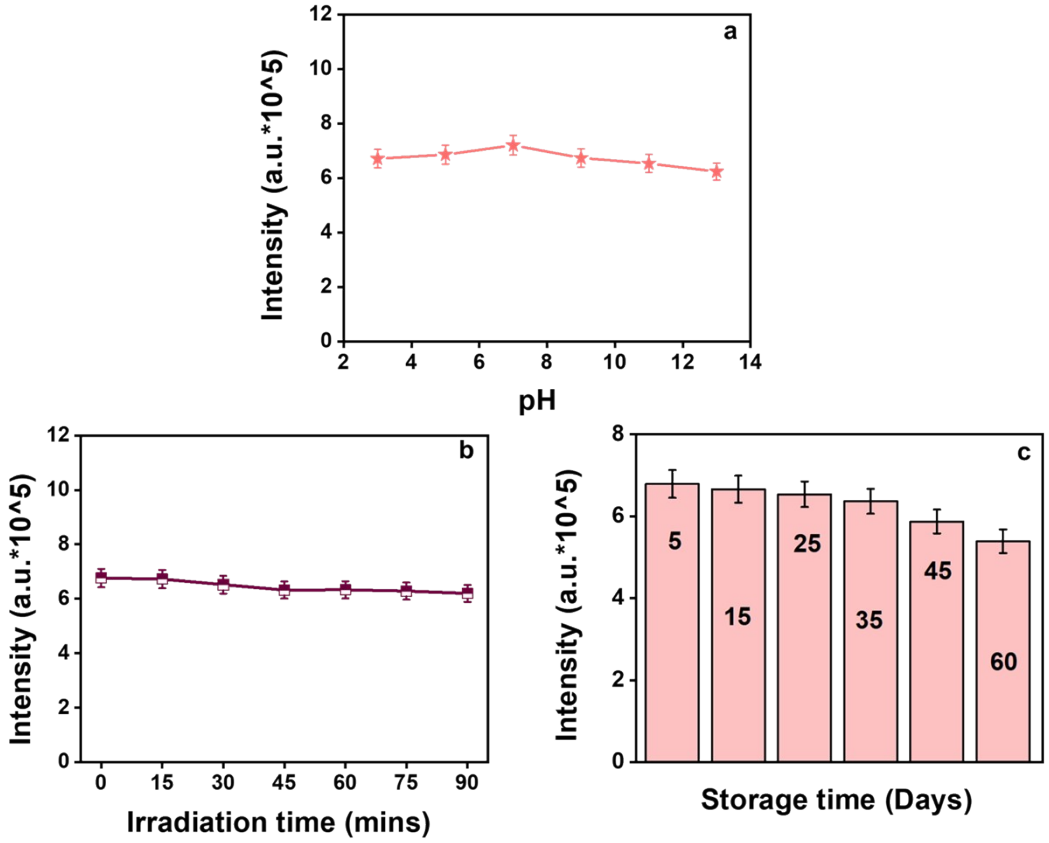

Figure S2. (a) The impact of pH (ranging from 2 to 13) on the PL emission characteristics of BP-CQDs, (b) the influence of irradiation time (in minutes), and (c) the effect of storage duration (in days) on the fluorescence emission properties of BP-CQDs.

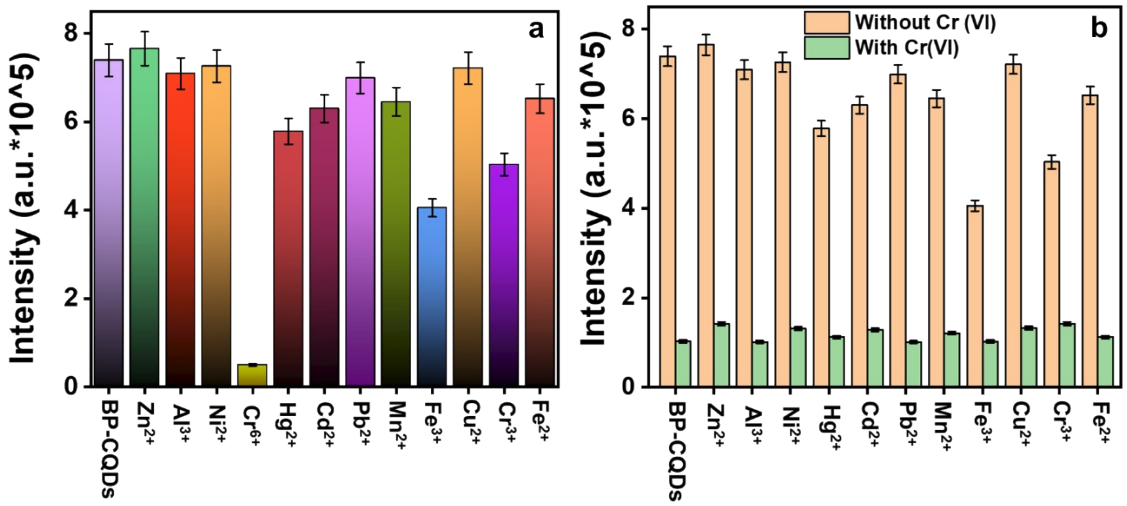

Figure S3. (a) Selectivity studies of BP-CQDs towards different metal ions, (b) Interreference study with and without Cr (VI) with different metal ions.

Figure S4. Triad Spectroscopy Sensor – AS7265x.

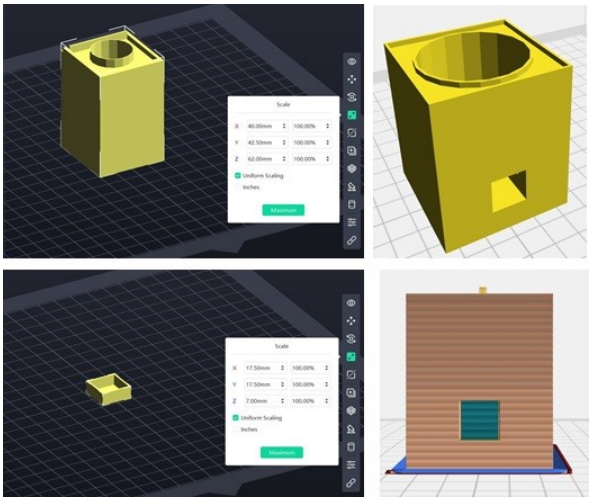

Figure S5. 3D printing design of device structure on Tinkercad.

Table S1. Measured UV detector data at three wavelengths (410 nm, 435 nm, and 460 nm) for the Cr (VI) (60 μL) and water (2000 μL) solution.

Concentration Cr (VI)	410 nm	435 nm	460 nm
0	2278.18	924.57	1825.41
20	2274.01	918.6	1814.92
40	2158.27	890.7	1793.95
60	2172.43	884.72	1770.12
80	2007.56	844.87	1746.29
100	1953.44	828.93	1728.18
120	1942.61	821.95	1711.97
140	1995.07	834.91	1701.16
160	1930.95	815.98	1689.86

180	1931.79	816.97	1683.38
200	1894.32	804.02	1679.75
220	1923.46	812.99	1673.71
240	1901.81	803.02	1670.03
260	1895.98	801.03	1667.17
280	1900.15	805.02	1662.17
300	1868.5	795.05	1661.45
320	1831.03	787.08	1656.69
340	1883.49	802.03	1656.55