Cubesats have become popular among universities, research organizations, and government agencies due to their low cost, small size, and light weight. Their standardized configurations further reduce the development time and ensure more frequent launch opportunities. Early cubesat missions focused on hardware validation and simple communication missions, with little requirement for pointing accuracy. Most of these used magnetic torque rods or coils for attitude stabilization. However, the intrinsic problems associated with magnetic torque systems, such as lack of three-axis control and low pointing accuracy, make them unsuitable for more advanced missions such as detailed imaging and on-orbit inspection. Three-axis control in a cubesat can be achieved by combining magnetic torque coils with thrusters, but the lifetime is limited by the finite fuel source. To maximize the mission lifetime, a fast attitude control management algorithm that could optimally manage the usage of the magnetic and thruster torques is desirable. Therefore, a recently developed method, the B-Spline-augmented virtual motion camouflage, is presented in this defense to solve the problem. This approach provides results which are very close to those obtained through other popular nonlinear constrained optimal control methods with a significantly reduced computational time. Simulation results are presented to validate the capabilities of the method in this application.