In this study, the hyperspectral imaging system (HSI) was designed and installed to detect various target molecules with multiplexing ability. Multiplexing ability of the HSI due to characteristic spectra of different materials and their structures is proposed to dynamically monitor the nanoscale processes and the change of environmental conditions, such as temperature and refractive index. Raman spectroscopy and Dark-field spectroscopy are mainly used for different purposes: Raman spectra can be used as a powerful tool especially for multiplexing detection and chemical identification with well-defined resolution, and Dark-field spectrum is good for motion tracking of dimer interaction in the range of distance from a few nanometers to 100 nm. Many different nanomaterials with spectral features in their response to the optical excitation have been employed as nanoprobe s for HSI applications. This study particularly focuses on the gold nanoparticle and the control of its surface plasmon resonance by forming a regulated structure.