ABSTRACT

Image quality is one of the important aspects in nanosatellite remote sensing mission. Image quality parameters, such as image detail and coverage area, have to be taken into consideration in designing nanosatellite remote sensing payload while limited mass, dimension, and power consumption on nanosatellite add another constraints. Lengthening the lens focal length of the camera can increase the image detail but this causes the smaller coverage area of the image. To maintain the detailed image with wide coverage area, the concept of synthetic aperture optical imaging can be used. Synthetic aperture optical imaging is a concept that combines images from array of camera capturing the same object from various angles to form the high resolution image.

In this research, synthetic aperture optical imaging interface will be developed based on FPGA. This interface is designed to integrate 4 camera modules which is arranged to form 2 x 2 array. XuLa2 LX9 FPGA Board is used as On Board Data Handling (OBDH) in this research to increase the system performance. XuLa2 LX9 also has low mass, low dimension, and low power consumption, makes it suitable for use in nanosatellite. Linksprite JPEG serial camera LS-Y201 is used as camera module which produces JPEG image with VGA resolution 640 x 480 pixels. This camera module uses CMOS as its sensor. UART serial communication is used in communication between camera and FPGA. System interface is designed by using VHDL programming language.

The result from the system built in this research is image with resolution 1280 x 960 pixels. From system testing using Indonesia map with scale of 1 : 4.750.000, this system produced image with coverage area 1425 km x 997,5 km with image capturing distance 14,7 cm or 700 km based on scale. The average transmission time is 27,58498 seconds for lowly compressed image and 11,1972 seconds for highly compressed image. Total mass of this system is 87 grams, quite light for nanosatellite specification, with small component size. This system needs 2,26544 W of power consumption. The system power consumption is quite high for nano satellite specification. Remote sensing payload with synthetic aperture optical imaging in this research fulfills low cost, low mass, and low dimension requirements of nanosatellite, but not low power. Image enhancement is also needed for further research to correct the detail of image produced from this research.

Keywords : nanosatellite, synthetic aperture optical imaging, FPGA, remote sensing payload, camera