Using Omnidirectional Cameras to Measure Position of a Motorcycle

Junji Hirasawa

1) Ibaraki KOSEN (College of Technology), Mechanical and Control Engineering
866 Nakane, Hitachinaka, Ibaraki, 312-8508, Japan (E-mail : hirasawa@ss.ibaraki-ct.ac.jp)

In this study, author proposed motorcycle position measurement method that use image processing technology. Previous paper shows that an omnidirectional camera is useful to acquire angle information in optical 180° plain. In this paper, "Smart Pylon" is described as a new measuring equipment that keep correct position of an omnidirectional camera. The optical axis of the camera was set to downward direction to get full motorcycle pictures at all position. Fig.1 shows the proposed disposition of Smart Pylons. The position of the object in $X_0Y_0Z_0$ coordinate, x and y, are calculated using next equation.

$$(x, y) = \left(L \frac{\cos\theta_1 \cos\theta_2}{\sin(\theta_1 - \theta_2)}, \frac{L}{2} \frac{\sin(\theta_1 + \theta_2)}{\sin(\theta_1 - \theta_2)} \right)$$

L is a distance from the center of the camera 1 to the center of the camera 2. θ_1 and θ_2 are relative angle from the center of the camera to the object shown in Fig.1. Samples of images captured by the omnidirectional camera are shown in Fig.2. The 2[mm] width slit which was made to the attachment for the omnidirectional camera works to decide the reference direction on the captured image. The omnidirectional camera, Kodak PIXPRO 4KVR360 can capture 1,920×1,920[px] images in 30 frames per second with "DOME" lens. Running test on a shape of the 8 figure with two smart pylons was carried out. The test vehicle is a small electric scooter (YAMAHA EF-06 e-Vino) equips with three inertial sensor units. IMS sensor unit (IMS-SD, Tec Gihan) includes 3 axes acceleration sensor, 3 axes gyro sensor and 3 axes geomagnetic sensor. Experimental results shows that the movies captured by omnidirectional cameras provide precision directional informations. Fig.3 shows the locus of running of first experiment, first lap. The position of the helmet was calculated by the derived equation and was plotted each 1[s] on Fig.3. Fig.4 shows the locus of running of second experiment, first lap. Fig.3 and Fig.4 shows that the proposed method to measure position is useful to get the locus of the running experiment with an actual motorcycle.
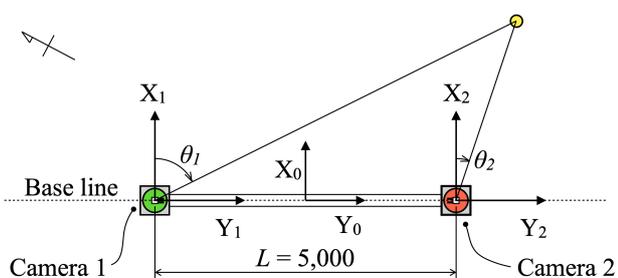

Fig.1   Disposition of smart pylons
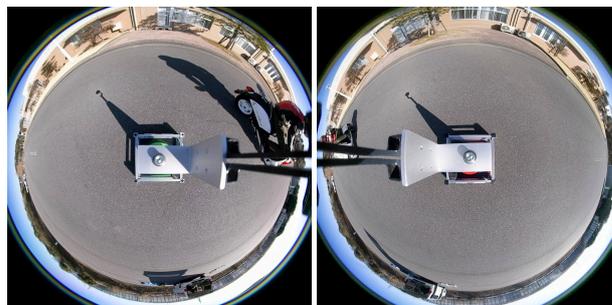
Fig.2   Captured images of Omnidirectional cameras
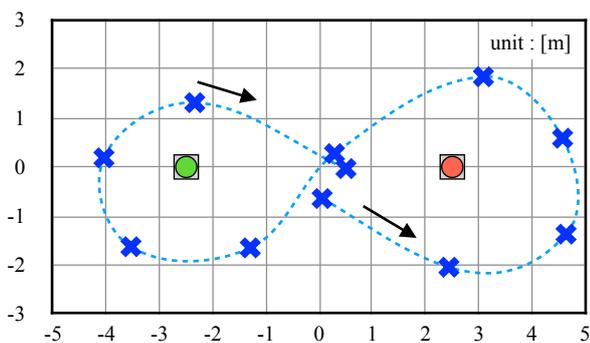

Fig.3   Locus of running (1st Ex., LAP1)
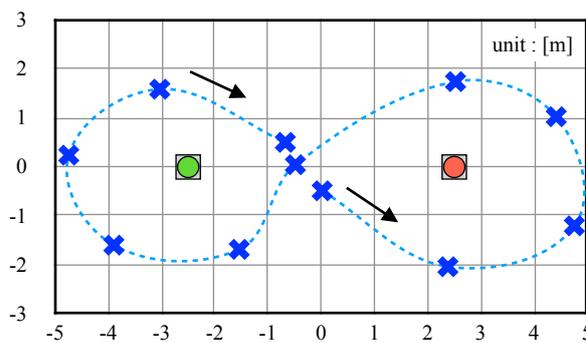
Fig.4   Locus of running (2nd Ex., LAP1)