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Measurement Using Omnidirectional Camera Images for Loci of a Motorcycle “8” Shape Running

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In this study, author proposed motorcycle position measurement method that use image processing technology. The measuring system using omnidirectional cameras is proposed to earn precious data for a motorcycle dynamics. Previous paper shows that an omnidirectional camera is useful to acquire angle information in optical 180° plain. Novel attachment design for an omnidirectional camera is described. It was verified that the proposed “Smart pylon” measurement system has enough precision with few centimeter error. But if the object is on the camera base line, the error becomes extremely big. In this paper, it is discussed based on actual measuring experiences. A small electric scooter was used to perform “8” shape running ,around “Smart pylons”.

The optical axis of the camera was set to downward direction to get full motorcycle pictures (including the rider, from the top to the toe) 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 omnidirectional camera, Kodak PIXPRO 4KVR360 can capture 1,920×1,920[px] images in 30 [fps] with “DOME” lens (angle of view 235°).

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 show that the movies captured by omnidirectional cameras provide precision visual informations that is useful to calculate the positions of the motorcycle.

Fig.3 shows the locus of running, nearby the middle point of the camera 1 and camera 2. The position of the helmet was calculated by the derived equation and was plotted each 1/30[s] on Fig.3. Within 0.2[m] from the base line, the error become extremely big.

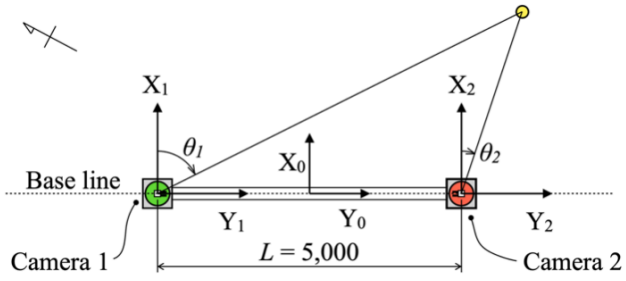
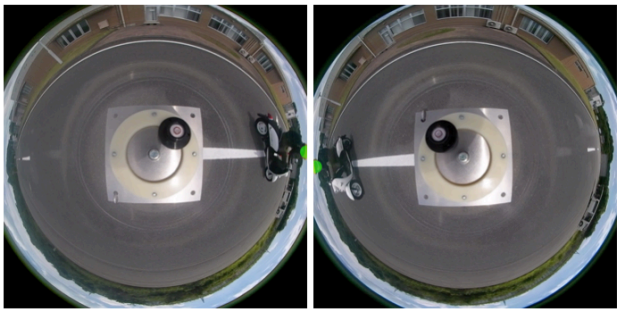


Fig.1 Disposition of smart pylons



Camera 1, 00:45 14f　　Camera 2, 00:52 8f

Fig.2 Captured images of Omnidirectional cameras

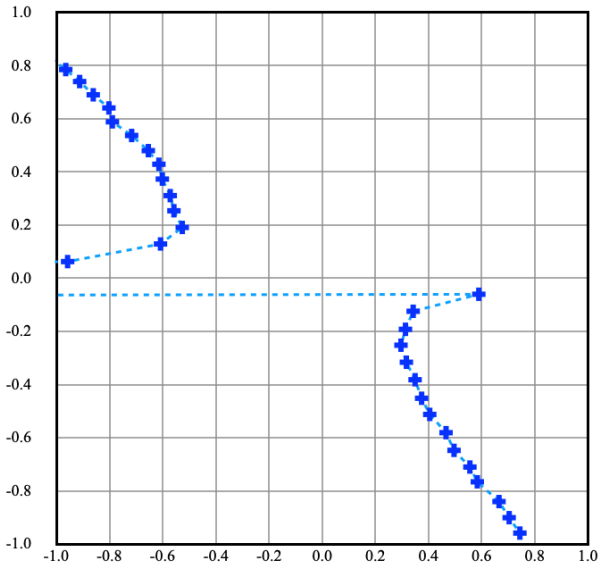


Fig.3 Locus of running (nearby the origin of $X_0Y_0Z_0$)