Mar 23rd, 10:35 AM - 11:55 AM

Experimental Development of a Bat Inspired Obstacle Mapping System

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This paper presents the development of an experimental method for obstacle detection using modified bat inspired navigation. Effective obstacle detection is vital to the efficient operation of many autonomous vehicles, mobile robotics and navigation systems. Varieties of sensors and sensor array combinations have been purposely developed to effectively detect and map obstacles and barriers during navigation [1][2]. Among these, ultrasonic sensors provide an inexpensive solution to distance and obstacle sensing. This is vital for industries such as automotive and transportation in which cost is a significant factor [3]. This work enhances the abilities of testing object classification capabilities of ultrasonic sensors through verification and proof of concept for bat-inspired, time of flight (TOF) based algorithms. Just as bats utilize acoustic echo to detect objects while navigating, this bat inspired system utilizes two static ultrasonic receivers and one central dynamic emitter. In our system, the electronic setup implemented was designed to activate a 40kHz emitter, capture the echo milliseconds later and incrementally move the emitter via the stepper motor. Upon activation of the emitter, the measurement device was triggered and the two distinct receiver signals were acquired. Receiver signals were then passed through a virtual low-pass filter and curve fitting algorithm in order to effectively and consistently determine the TOF values. Internal circuitry delays between trigger time and time of emission was accounted for through a test case with known orientation and speed of sound. Lastly the inherent nature of a diffuse detection surface permitted the detection of reflected signals from all emitter orientations. The experimental methodology developed in this research was successfully tested for detecting walls with a low cost ultrasonic emitter and receiver, setting a basis for analysis of future TOF based detection algorithms. The outcome of this research has the potential to provide effective barrier detection systems for autonomous navigation systems.

References

[1] L. Kleeman and R. Kuc, “Mobile Robot Sonar for Target Localization and Classification,” *The International Journal of Robotics Research*, vol. 14, no. 4, pp. 295–318, 1995.

[2] K. Fuerstenberg, K. Dietmayer, and V. Willhoeft, “Pedestrian recognition in urban traffic using a vehicle based multilayer laserscanner,” *Intelligent Vehicle Symposium*, vol. 1, pp. 31-35, 2002.

[3] Roselli, L., et al. "A cost driven 24GHz Doppler radar sensor development for automotive applications." *Microwave Conference, 2005 European*, vol. 3, p.4 pp.-2062, 2005.