Integrated Self-Powered Bicycle Wheel Light

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Exactly half of 2014 bicycle fatalities were at dusk, dawn, or night, according to NHTSA, yet only 20% of bicyclists ride at night. Improvements in overall bicycle visibility through use of integrated, self-powered wheel lights developed in this project may decrease fatal nighttime accidents by allowing motorized vehicle drivers more reaction time. Piezoelectric transducers (PZTs) convert mechanical strain into usable power. Embedded between tire and inner tube, PZTs harvest energy from the changing shape of tires to power small intermittent LED lights on wheel spokes. Four different PZTs were tested with as many as 3 PZTs in a circuit. Each was drop tested 39 times, totalling almost 800 events. Drop tests showed that 170 mm flexible PZT strips outperformed 20 and 27mm PZT disks and 20mm tabs. LEDs flash twice when their PZTs are activated in the wheel: once when the contact patch first activates the PZT and again as the PZT is released. The 170mm strip lit LEDs during 15^o of movement, including flash and feature fusion effects, and flashed again 30^o away. By offsetting subsequent PZTs, gaps between flashes are filled with a second LED's flash, achieving 60o light coverage on the leading edge of the wheel. Using a 5cm LED strip creates an illuminated area 149 cm^2, much larger than the standard 25 cm^2 standard reflector which only works in direct beams of oncoming vehicles.

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