Wireless Vehicle Presence Detection Using Self-Harvested Energy

By

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Abstract

Rising from the “excess demand” modern societies and economies place on limited road resources, congestion causes increased vehicle emissions, decreases national efficiency, and wastes time (Downs, 2004). In order to minimise congestion’s impacts, traffic management systems gather traffic data and use it to implement efficient management algorithms (Downs, 2004). This dissertation’s purpose has been the development of a distributable vehicle presence detection sensor, which will wirelessly provide vehicle presence information in real time. To address the sensor’s wireless power requirements, the feasibility of self-powering the device via harvested energy has been investigated. Piezoelectric, electrostatic, and electromagnetic energy harvesting devices’ principles of operation and underlying theory has been investigated in detail and an overview presented alongside a literature review of previous vibration energy harvesting research. An electromagnetic energy harvesting device was designed, which consists of: a nylon reinforced rubber bladder, hydraulic piston, neodymium magnets, and wire-wound coil housing. Preliminary testing demonstrated a harvested energy between 100mJ and 205mJ per axle. This amount is able to be transferred to a 100Ω load when driven over at speeds between 10km/h and 50km/h. Combined with an embedded circuit, the energy harvester facilitated the development of a passive sensor, which is able to wirelessly transmit a vehicle’s presence signal to a host computer. The vehicle detected event is displayed via a graphical user interface. Energy harvesting’s ability to power the embedded circuit’s wireless transmission, demonstrated the feasibility of developing systems capable of harvesting energy from their environment and using it to power discrete electronic components. The ability to wirelessly transmit a vehicle’s presence facilitates the development of distributable traffic monitoring systems, allowing for remote traffic monitoring and management.

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