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Títol de la tesi

Sensor autónomo para detectar vehículos estáticos

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ABSTRACT

The demand for a safe and smooth traffic flow in our roads in the face of ever increasing traffic volumes and a limited number of available roads and parking lot spaces, asks for the implementation of effective traffic management solutions able to guarantee the safety and efficiency of road traffic and to meet pollution control requirements. Time spent looking for a parking spot decreases if there is an accurate real-time inventory of available parking places. In order to prevent the congestion and parking problems from getting worse, particularly at rush hours, some governmental departments initiated the so-called Intelligent Transportation Systems.

The most important prerequisite for traffic management is information about the traffic flow and one way to obtain the required data is through vehicle detectors. These should ideally be small, sturdy, low power, easy to install and maintenance-free.

Currently available vehicle detector systems are based on the classical inductive loop, magnetic, ultrasound, and infrared sensors. They are mainly applied in parking management systems where there is a sensor above each parking spot, connected into a wired network. Those sensors are expensive, power-hungry and expensive to deploy and maintain, so they are not suitable for sensor nodes in wireless sensor networks.

Because of the very high deployment and maintenance costs, wired sensors networks to cover large areas would be impractical. It is far more economical and power-efficient to use battery-powered sensor nodes and wireless communications. Wireless sensor network is a technology that combines networking software with ultra low-power sensor nodes and radio transceivers to enable sensor applications on a density and scale that were unthinkable of twenty years ago. However, wireless sensor networks will probably be an integral part of most ITS systems in the near future.

This dissertation presents the conception, design and implementation of a wireless vehicle detector (sensor node) to detect the presence of a vehicle in a predetermined zone. The sensor node proposed includes two passive sensors: magnetic and optical. Magnetic sensors based on magnetoresistors are quite sensitive and can detect magnetic anomalies resulting from the presence of a car. However, they can be fouled by a close magnet, or another ferromagnetic material, and its continuous operation implies large power consumption. Optical sensors can detect a reduced illumination resulting from the presence of a car, or any other object. However, they can be designed to consume very little power. As a result, combining both sensors can result in a sensitive but also specific and low power sensor node. This goal has been achieved by designing new interface circuits and software detection algorithms, and by applying power management strategies. The result has been a vehicle detector that is simple, compact, low power, and easy to install and maintain.

Theoretical and experimental analysis show that resistive sensors in quarter, half-, and full-bridge configurations can be directly connected to a microcontroller without using any analogue integrated circuit in the signal path. Such a direct interface circuit relies on measuring the discharging time of an RC circuit network that includes the resistances of the bridge. This interface circuit is a simple, compact, low-cost, and low-power solution for wireless sensor nodes intended for measurement and control systems in many application areas such as industrial automation, remote metering, building and home automation, automotive networks, and vehicle detection and traffic data. Further, we show that life-time of the sensor

node is greatly extended by using software and hardware based on events.

The wireless sensor node proposed is a very attractive alternative to inductive loop detectors. Wireless sensor networks are reconfigurable, which makes the system scalable and deployable everywhere in existing or new traffic and parking networks, at a much lower life-cycle cost than inductive loops, ultrasound and infrared detector systems. Further, also sensor networks are cost-effective to cover large areas. Wireless communication allows the interchange of traffic parameters between different ITS systems. Because sensor nodes are located on the pavement, a multifunction wireless surveillance system could be deployed by adding other sensor modalities to the ITS. For example, to sense road conditions such as temperature, snow, moisture, and pollutants. All this information could be the basis for an accurate, real-time inventory of available parking places, road conditions and traffic statistics systems.

Lloc i data

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