VEHICLE DETECTION SYSTEM USING TUNNEL MAGNETORESISTANCE SENSOR

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Abstract. Vehicle detectors are useful to provide essential information such as parking occupancy and traffic flow. To create one robust vehicle detector which works not only in controlled environment (*i.e.* indoor), but it should also work in outdoor environment, a vehicle detection using magnetic approach is proposed. The magnetic signal of a vehicle will be measured based on magnetic remanence technique where it will be processed to a cloud database. To achieve a low-cost and sensitive system, a Tunnel Magnetoresistance (TMR) sensor is employed. With the combinations of software filter and state machine's algorithm, the occupancy of the car park can be identified with high accuracy. After a few series of real field testing, it is shown that a vehicle in a parking lot can be detected by measuring the surrounding magnetic field that is disrupted by the presence of vehicles. The proposed system is tested for forward and reverse parking, and it shows a high accuracy detection for a B-segment sedan car. It can be expected that by using the proposed technique, detection of vehicles using a low-cost system with capability of online monitoring can be realized.

Keywords: Tunnel magnetoresistance, magnetic sensors, vehicle detectors.

1   Introduction

Intelligent transport [1], smart cities [2], [3] and Internet of Things [4] are terms that surround us all the time in this century. With growing population, mobility of people using vehicles will increase rapidly and this will result to severe issues such as parking problem of vehicles. Hence, intelligent and centralized solutions to lessen these problems are highly desired, where specifically in the case of vehicle parking problem, gathering and online monitoring data about traffic flow and absentees of vehicle in a parking slot are important. Based on the real-time data, traffic congestion and the required time to find a vehicle parking slot can be mitigated by efficiently controlling the flow of vehicles.

In conventional ways of vehicle detection, ultra-sonic sensor is used to obtain the information of parking spot due to its low cost, easy installation, and high accuracy. The vehicle detection using the ultrasonic sensor works by emitting radio waves and detecting the reflected radio waves. This method works efficiently in a controlled environment such as inside indoor; however, it is sensitive to the fluctuations of tem-