

# Speed estimation of vehicles approaching an intersection, a digital image processing method

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**Abstract—** Most severe car accidents that occur in urban environments involve side impacts at street intersections, even at those regulated with traffic lights. Hence, it is very common to implement a small delay since one road changes to red until the other road changes to green. This delay is intended to avoid accidents in which a vehicle decides to go through the intersection after the sequence green-orange-red is started, underestimating the time required to overtake the intersection. A better approach is to adjust the delay dynamically; depending on the speed of the vehicles approaching to the intersection. Using the dynamic approach it is possible to improve traffic flow by reducing unnecessary delays, and to improve safety by applying longer delays when needed. This paper proposes a speed estimation method based on digital image processing of pictures taken with wireless cameras installed on top of existing traffic lights. The algorithm finds a vehicle in two consecutive images (either in day or night condition) and computes its speed by correlation. When a traffic light turns red, the system estimates the speed of the cars approaching and decides to change the other road to green immediately, or to wait until it is safe to do so. The system was tested with real traffic flow at a street located in the city of Talavera de la Reina, Spain, with vehicles at different speeds. The image processing method proved to be accurate for this application, and adding the advantage of low cost equipment and easy installation results in a very attractive solution.

**Index Terms—** vehicle speed estimation, digital image processing, intelligent transportation, systems, road safety

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