

# Design of ETC Violation Enforcement System for Non-payment Vehicle Searching

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**Abstract**—As we know, the heaviest traffic congestion on highways occurs near toll gates where vehicles make a short stop to pay the toll. So an electronic toll collection (ETC) system is usually built to eliminate the traffic jams. In order to find out the non-payment vehicles, the violation enforcement usually includes cameras to capture images of license plates, and a license plate reader system to recode photographs and license plate numbers of all vehicles. Thus, automatic license plate recognition (ALPR) technology is often used in violation enforcement. However, the identification precision of ALPR is not always reliable. Human review and correction will be needed to improve the accuracy and therefore will result in extra manual operation cost. In this paper, we consider multilane-free-flow ETC systems and formulate the non-payment vehicle searching problem into a matching problem and propose a Photograph-to-Transaction matching algorithm (PT algorithm) based on bipartite graph. The PT algorithm not only can reduce the human loading to review and correct the image recognition results but also can accurately identify all non-payment vehicles. The performance of the PT algorithm was evaluated in ns-2 simulator and three different traffic scenarios: congested traffic, normal traffic and sparse traffic. The simulation results show that our algorithm greatly reduce the number of plate recognitions, and is more feasible and reliable for ETC enforcement. This will activate some consequent activities against the violation vehicles.

**Keyword**—ETC, multilane free flow, violation enforcement, bipartite graph, matching.



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