ABSTRACT

Increasingly congested and complex traffic in Indonesia has led to an increased risk of traffic violations that can threaten the safety of road users. Conventional methods for detecting traffic violations, such as CCTV cameras, have limitations in their coverage area and mobility. This complicates law enforcement efforts and results in high rates of violations that go undetected. In this context, the use of drones as a traffic monitoring tool offers the potential to increase the efficiency and effectiveness of traffic violation detection.

This study proposes a drone-based traffic violation detection system that integrates visual sensing and artificial intelligence technologies. Drones are able to cover a wider area and can reach locations that are difficult to reach by fixed cameras. By combining drone and object detection technology, it will be used to detect violations such as not wearing a helmet, stopping above the zebra crossing line, and being able to recognize the license plate digits of the vehicle using optical character recognition technology. The system will be supported by an artificial intelligence algorithm that has been trained to identify patterns of traffic violations from captured images. Data obtained from drones will be processed in real-time and can be accessed by law enforcement agencies for further action.

Initial testing of a traffic violation detection system using drones has shown promising results. Drones are capable of detecting the types of traffic violations mentioned above with satisfactory accuracy. The combination of drone technology, object detection and optical character recognition produces a system that can effectively identify traffic violations with high timeliness. The model training process involves a data split of 88% for training and 12% for validation and testing, with a learning rate of 0.0001, a batch size of 8, and run over 100 epochs. The achieved parameters from this model indicate a precision of 0.742, recall of 0.798, F1-score of 0.768, mAP@[0.5] of 0.81, and mAP@[0.5:0.95] of 0.592. In terms of application, this model produces an accuracy level of 60.044% in detecting helmet violation, 50.034% for detecting stopping at crosswalks for 3 seconds, and 4.456% for Optical Character Recognition. In field tests, the system managed to capture traffic violations that were previously difficult to monitor with fixed cameras, proving the potential of drones as an innovative solution in efforts to improve traffic safety and law enforcement. With further development, this system will potentially become a very useful tool for authorities dealing with traffic safety in the future.

Keywords: Drone, *Object Detection*, *Optical Character Recognition*, helmet, zebra cross