

ABSTRAK

BAIQ PUTRI SUARTIKHA. IMPLEMENTASI MODEL *DEEP LEARNING* DALAM DETEKSI *SPACE* PARKIR UNTUK SISTEM PARKIR CERDAS. dibimbing oleh Agus Mulyanto, S.Kom., M.T., M.Sc. Keterbatasan informasi ketersediaan parkir menyebabkan pengguna harus mencari slot kosong secara langsung dan menyulitkan pengelola dalam memantau kondisi parkir secara terstruktur. Penelitian ini bertujuan mengembangkan *prototype* sistem parkir cerdas yang mampu mendeteksi kendaraan dan menentukan status slot parkir menggunakan video CCTV simulasi. Penelitian menggunakan *Design Science Research Methodology* melalui tahapan identifikasi masalah, penetapan tujuan, desain dan pengembangan, demonstrasi, evaluasi, serta komunikasi. Dataset dibentuk dari 500 *frame* awal dan setelah pemeriksaan anotasi menghasilkan 492 gambar yang terdiri atas 349 data *training*, 70 *validation*, dan 73 *testing*. Model YOLO26n dilakukan *fine-tuning* untuk mendeteksi kendaraan, kemudian hasil deteksi dipetakan terhadap sebelas *polygon Region of Interest* dan diproses melalui pembacaan beberapa *frame* berurutan untuk menentukan status Kosong atau Terisi. Pengujian menghasilkan *precision* 0,9413, *recall* 0,9647, *mAP@50* 0,9866, dan *mAP@50–95* 0,9707. Sistem mengintegrasikan FastAPI, MySQL, dan *dashboard* PHP untuk menampilkan status terkini, *snapshot* CCTV, serta riwayat parkir. Pengujian kesesuaian status pada sebelas slot pada *frame* referensi menunjukkan seluruh status sesuai dengan kondisi visual yang diamati. Pengujian *black box* terhadap lima responden dengan sepuluh skenario menghasilkan 50 eksekusi dan seluruhnya berstatus Berhasil. Hasil penelitian menunjukkan bahwa *prototype* mampu menyajikan informasi ketersediaan parkir secara terstruktur. Namun, penggunaan satu video CCTV simulasi membatasi variasi kondisi pengujian sehingga diperlukan evaluasi lebih lanjut pada lingkungan parkir nyata.

Kata kunci: deep learning, deteksi kendaraan, sistem parkir cerdas, video CCTV, YOLO26n.

ABSTRACT

BAIQ PUTRI SUARTIKHA. IMPLEMENTATION OF *DEEP LEARNING* MODEL IN PARKING SPACE DETECTION FOR SMART PARKING SYSTEM. Supervised by Agus Mulyanto, S.Kom., M.T., M.Sc. *Limited parking-availability information requires users to search for vacant spaces directly and makes structured monitoring difficult for parking managers. This study aims to develop a smart parking system prototype capable of detecting vehicles and determining parking-slot status using simulated CCTV video. The study applies the Design Science Research Methodology through problem identification, objective definition, design and development, demonstration, evaluation, and communication. The dataset was generated from 500 initial frames and, after annotation inspection, resulted in 492 images consisting of 349 training, 70 validation, and 73 testing images. The YOLO26n model was fine-tuned for vehicle detection, after which the detection results were mapped to eleven polygon-based Regions of Interest and processed across multiple consecutive frames to determine Available or Occupied status. Testing produced a precision of 0.9413, recall of 0.9647, mAP@50 of 0.9866, and mAP@50–95 of 0.9707. The system integrates FastAPI, MySQL, and a PHP dashboard to display current parking status, CCTV snapshots, and parking history. Status-conformity testing on eleven parking slots in the reference frame showed that all generated statuses matched the observed visual conditions. Black-box testing involving five respondents across ten scenarios resulted in 50 test executions, all of which were successful. The findings indicate that the prototype can provide structured parking-availability information. However, the use of a single simulated CCTV video limits the variation of testing conditions, so further evaluation in real parking environments is required.*

Keywords: deep learning, smart parking system, vehicle detection, video surveillance, YOLO26n.