

ABSTRACT

Visually impaired individuals face significant challenges in daily mobility due to vision limitations, directly impacting their independence and safety. Conventional solutions such as white canes, guide animals, and human companions have functional and availability limitations. With advancements in technology, the need for computer vision-based solutions that can operate in real-time with high accuracy has become more pressing. This research aims to develop an object detection system using the YOLOv5 algorithm to assist the mobility of visually impaired individuals by providing visual information in the form of voice output. This system not only identifies types of objects (benches, bollards, cars, motorcycles, people, signs, pillars, trees, pots, trash cans, and poles) but also determines object positions based on a 9x9 grid and estimates relative distances (near, medium, far) based on the object's bounding box area ratio. The development process follows the CRISP-DM methodology, starting with the collection of image data from Roboflow and manual captures around environments frequently traversed by visually impaired individuals. The data was then labeled with bounding boxes according to the desired object classes and divided into training, validation, and testing sets. The YOLOv5 model was trained using 100 epochs, an image size of 640×640 pixels, and a batch size of 16 on the Google Colab platform with an NVIDIA Tesla T4 GPU. Evaluation results show good model performance with detection accuracy above 85% for all object classes, achieving a mean Average Precision (mAP) of 0.934 at IoU 0.5. The system's implementation as a desktop application with a .exe extension using PyInstaller allows accessibility without needing a terminal, providing informative voice output. This research is expected to significantly enhance the independence and safety of visually impaired individuals in their daily activities.

Keywords : Object Detection, Visually Impaired, YOLOv5, Computer Vision, Mobility, Real-time, Voice Output.