Patent Search

Invention Title	A Method and System for Detecting Roadside Waterlogging Using Hybrid Semantic Segmentation and Depth Cues
Publication Number	01/2026
Publication Date	02/01/2026
Publication Type	INA
Application Number	202541120363
Application Filing Date	02/12/2025
Priority Number	
Priority Country	
Priority Date	
Field Of Invention	COMPUTER SCIENCE
Classification (IPC)	G06V 20/40, G06V 20/52, G06V 10/764, G06K 9/00, G06V 10/774

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Abstract:

The invention relates to a method and system for identifying and assessing real-time roadside waterlogging using a short video captured using a smartphone. First, the sys processes the video through a lightweight semantic segmentation model to isolate the water regions and applies a monocular depth estimation model to predict depth-re cues. These complementary outputs from both the models are analyzed together to estimate the severity of waterlogging. Based on the severity, the road condition is clas into one of several risk levels. The device finally presents a visual along with an audio alert to the user. The method operates completely on-device, without any need for th Internet or requirement of external servers. The system enables highly affordable and immediate hazard detection for drivers and pedestrians.

Complete Specification

Description:The following description outlines preferred embodiments of the invention. These examples specified illustrate, but do not limit the scope of the invention.

1. Video Acquisition - A smartphone records a continuous video stream or a short clip (2–5 seconds) using its integrated camera. Frames are extracted at suitable interv and pre-processed to normalise brightness and resolution.
2. Pre-processing Module - This module may include one or more of the techniques like, exposure adjustment, noise reduction, colour normalisation, region-of-interes (ROI) cropping, to ensure consistent input for later stages.
3. Semantic Segmentation Module - A lightweight segmentation network based on SegFormer-B0 identifies regions that resemble water on the road surface. Other suitable models include Fast-SCNN, BiSeNetV2, MobileNet-based variants, or equivalent architectures capable of real-time inference. The output is a pixel-wise segmentation mask indicating probable water regions.
4. Depth Estimation Module - A monocular depth estimation model processes the same frame to generate depth cues. Although absolute depth may not be accurate c reflective surfaces, relative variations provide valuable structural information.
5. Fusion and Risk Analysis - The segmentation and depth outputs are jointly analysed. The invention computes metrics such as: segmented water area, spatial distribution of water patches, relative depth values within these patches, distance of water from the projected path of the user, persistence of detections across consecu frames. These metrics contribute to a Waterlogging Risk Index which reflects potential hazard.
6. Risk Classification - The Waterlogging Risk Index is mapped to discrete categories such as: Safe (minimal or shallow water), Caution (moderate or uncertain depth) ar Dangerous (significant or deep water)

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