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A new geo-sensing system to monitor seepage effects at transportation infrastructure

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Real-time condition assessment of transportation systems is critical considering these have been constructed over the past decades with now outdated designs and in the majority of the cases without taking into account the current climatic variability. One of the most vulnerable elements of these infrastructure systems are embankments and geo-structures near water bodies, as flowing water typically has a degrading impact on their performance. Water-related hazards can increase seepage effects which can be the main cause for their structural failure. Floods can also accelerate internal seepage processes occurring inside the body of geo-structures, due to a combined effect of the high permeability of soil and increased hydrostatic pressure, worsening the risks of catastrophic failures [1].

The difficulty in detecting seepage processes inside the body of geo-infrastructure with conventional methods leads to irreversible effects with major disruption and costs to road asset owners, maintainers and users. The need to obtain real-time information about the evolution of geomorphological hazards is therefore considered to be of significant importance considering the ageing infrastructure, constructed near geomorphologically active rivers, and the extreme shifting climatic conditions [2].

This study presents the development of a new sensing system aiming to provide advanced information about seepage processes inside the body of geo-structures. The main principles around the sensor's operation are presented alongside with implementation and installation procedures for optimum application. Finally guidelines about their efficient incorporation into existing sensing and management platforms are provided. The proposed sensing system is expected to enhance the response capabilities of asset owners providing advanced warnings about the condition of infrastructure, increasing commuters' safety and resilience of transportation systems to climatic hazards.

References

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