



Low-cost Sensors Using Raspberry Pi Technology

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The emergence of ‘low-cost sensing’ approaches are opening up unprecedented opportunities for high spatial and temporal monitoring and analysis of the environment. This research presents a novel method for remotely capturing hemispherical imagery of tree canopies using low-cost technology. The monitoring of trees is of significant interest to the UK rail industry where leaves on the line are a common issue throughout autumn, leading to considerable costs and delays. A Raspberry Pi was modified to take near-infra red hemispherical images using a PiNoIR camera and a specially adapted fish eye lens. Near-infra red is used to allow for a clearer view of the tree canopy due to the spectral properties of vegetation thus improving upon conventional hemispherical cameras. The device relays data to the cloud and has been tested over a three month period during autumn where it has demonstrated the ability to record daily changes / leaf-fall in the tree canopy. This data can then be used to improve autumn resilience on the railways by improved leaf fall forecasts and low adhesion monitoring in order to reduce delays and save money for the rail industry. This sensor also has the potential to be used for other applications which currently uses hemispherical photography, such as urban greening and forest climatology.