



"පවුර" (Pawura, Sinhala Term for "protection"): An Integrated Platform for Coastal Erosion Prediction and Coral Reef Health Monitoring in Trincomalee, Sri Lanka

J.M.A.Y.R. Jayakody¹, R.A.D.N. Rupasinghe¹, N.T.A. Rathnayake¹, N.T. Weerawarna¹, D.T. Rupasinghe^{2*}

¹Department of Information and Communication Technology, Faculty of Technology, University of Colombo, Sri Lanka.

²Coast Conservation and Coastal Resource Management Department, Maligawatte, Colombo 10, Sri Lanka.

*nethmini@tech.cmb.ac.lk

Coastal erosion and coral reef degradation are major environmental threats along the eastern coastline of Trincomalee, where chronic shoreline recession and limited real-time reef monitoring constrain effective coastal management. Pigeon Island Marine National Park, one of Sri Lanka's most ecologically significant coral reef systems, currently relies primarily on periodic diver-based assessments and limited satellite observations. This study presents "පවුර" (Pawura), an integrated coastal monitoring platform combining satellite-based shoreline analysis with a low-cost Internet of Things (IoT) reef monitoring buoy. The coastal erosion module utilised multi-temporal Sentinel-2 imagery (2014–2024) processed using CoastSat and the Modified Normalized Difference Water Index (MNDWI) within the Google Earth Engine. Extracted shorelines were analysed using the Digital Shoreline Analysis System (DSAS) to estimate Linear Regression Rates (LRR) and generate 2030 and 2035 shoreline projections. Preliminary analyses indicate erosion rates of up to -2.1 m/year at Alas Garden Beach. The coral reef monitoring module consists of a low-cost, solar-powered IoT buoy based on an ESP32 microcontroller with sensors for temperature, pH, turbidity, GPS location, and battery monitoring. Sensor data are transmitted every two hours via LoRa communication to an onshore gateway and cloud database. The system architecture supports autonomous long-term deployment with an estimated hardware cost of approximately USD 85, considerably lower than comparable commercial monitoring systems. Data from both modules are integrated into a Streamlit-based web dashboard providing near-real-time reef health indicators, shoreline change visualisation, DSAS transect analysis, and future shoreline projections. The platform demonstrates the potential of combining remote sensing and low-cost IoT technologies to support coastal conservation, reef monitoring, and evidence-based shoreline management in Sri Lanka.

Keywords: Coastal erosion, Coral reef monitoring, Internet of Things, Satellite remote sensing, Sri Lanka