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Smart-WT: an IoT device for remote water level monitoring in rice paddies

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Effective irrigation management is particularly challenging in rice cultivation, especially when the Alternate Wetting and Drying (AWD) strategy is employed. This technique requires frequent monitoring of water level in field-installed water tubes (WT) to determine the optimal timing for reflooding the field. Daily manual measurements are time-consuming and may limit large-scale implementation.
This study presents Smart-WT, a remote monitoring system for continuous measurement of ponding water level in rice paddies. The system is based on a fully open-source architecture and uses an Arduino Nano combined with a GSM board for data acquisition and transmission. The device is waterproof, low-power, and battery-operated (approximately three months with two-hour transmission intervals), with the option of photovoltaic integration. Water level is measured through an ultrasonic measuring sensor installed above a WT inserted in the soil, perforated below the soil surface and blind above, enabling measurements both above and below the soil surface.
Laboratory and field tests assessed sensor accuracy and the influence of pipe characteristics and environmental temperature, highlighting the importance of appropriate pipe sizing for reliable measurements.
During the 2023–2025 seasons, Smart-WT was used on several rice farms in the Lomellina area to support AWD irrigation management under different field conditions.

Keywords: Open-source technology; IoT; Irrigation management; Alternate Wetting and Drying; Arduino