

ABSTRACT

Monitoring environmental parameters in plantation areas is an essential aspect of maintaining plant health and productivity, particularly through the observation of temperature, humidity, and air pressure. This study implements an Internet of Things (IoT)-based monitoring system utilizing the LilyGo T-Beam LoRa 915 MHz microcontroller integrated with the SHT31 sensor, INA219 sensor, and GPS module. The system is designed to operate autonomously using solar panels as the primary power source, regulated by the MPPT CN3791 module to maximize charging efficiency. All measurement data are transmitted in real-time to the ThingsBoard platform via a WiFi connection and subsequently processed to calculate the Vapor Pressure Deficit (VPD) as a key parameter for identifying potential plant stress due to humidity imbalance. Test results show that during the observation period, the VPD distribution consisted of approximately 35% in the low category (0.0428–0.1999 kPa), indicating high air humidity with minimal transpiration risk, and about 65% in the medium-to-high category (≥ 0.5 kPa) with a peak value of 1.3517 kPa, representing critical conditions for plants. These findings demonstrate that the developed system is capable of accurately monitoring and analyzing microclimate dynamics while providing significant information to support decision-making in tea plantation management.

Keywords: Internet of Things, Long Range, SHT31, INA219, CN3791, VPD