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ONION GUARD: AN IOT-BASED ONION SPOILAGE RISK DETECTION SYSTEM

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ABSTRACT

Post-harvest onion storage is vulnerable to spoilage caused by microbial activity and unfavourable environmental conditions, resulting in significant agricultural losses. An Internet of Things (IoT) based monitoring system was implemented to enable early spoilage detection by monitoring volatile organic compound (VOC) emissions, temperature, and humidity within storage environments. The system used an ESP32 microcontroller integrated with an MQ-135 gas sensor for VOC detection and a DHT22 sensor for environmental monitoring. The collected data were processed to compute an Onion Spoilage Risk Index (OSRI), representing the combined influence of gas concentration, temperature, and humidity on storage stability. Sensor data were transmitted to the cloud through MQTT communication using AWS IoT and visualized in real time via a Node-RED dashboard. Experimental evaluation showed that the calculated OSRI, derived from VOC concentration, temperature, and humidity, remained below 0.45 under normal storage conditions, indicating safe storage. When environmental changes increased the OSRI beyond the threshold, spoilage risk was detected, and a ventilation process was activated to reduce gas accumulation. The monitoring system achieved an overall detection accuracy of approximately 88%. Future work includes extending the system to support spoilage monitoring for multiple vegetables and integrating improved sensing and analytical methods to further enhance detection accuracy and enable intelligent agricultural storage management.

KEY WORDS: Early Spoilage Detection; Onion Storage Monitoring, Smart Agriculture, Post-Harvest, Loss Reduction.