

ABSTRACT

Rice is an essential staple food in Indonesia, necessitating strict quality management in large-scale storage facilities like Perum BULOG. Water content is a critical factor influencing rice quality; high moisture can lead to pest and harmful mold (e.g., Aspergillus producing aflatoxins) growth, causing spoilage and economic losses, while low moisture can also degrade processed product quality. The Indonesian National Standard (SNI) sets a maximum moisture content of 14% for marketable rice. However, conventional devices such as gravimetric methods or grain moisture meters are deemed inefficient for large-scale rice moisture content measurement.

To address these challenges, this research successfully designed and implemented an integrated "Rice Moistrack" system utilizing an antenna, Internet of Things (IoT) technology, and a website interface for fast and non-destructive rice moisture content detection. The system relies on a 2.4 GHz microstrip rectangular patch antenna serving dual functions; as the primary sensor detecting moisture content variations through return loss (S_{11}) parameter changes, and as a communication module demonstrating effective performance with a received power range of -50 dBm to -76 dBm for IoT integration.

The relationship between return loss and moisture content was successfully modeled using a 3rd-order polynomial curve fitting, chosen for its best performance indicated by an R^2 value of 0.9470 and an RMSE of 0.4658, validated through the gravimetric method. The overall system demonstrated over 85% measurement accuracy compared to gravimetry across dry, normal, and wet rice samples, with results displayed real-time on an OLED and website. Nevertheless, certain specifications were not fully met, including the device's portability target (actual dimensions 34 cm x 10 cm x 30 cm) and data display time exceeding 10 seconds from detection button press, which slightly impacted real-time performance.

Keywords: IoT, Microstrip Antenna, Moisture Content, Non-destructive, Rice.