

ABSTRACT

Boiled eggs are among the most widely consumed foods in society; however, determining their doneness level has conventionally relied solely on time estimation without accounting for water temperature, which also significantly affects the boiling process. This limitation can result in inconsistent and inaccurate doneness outcomes. This research designed and realized an automatic boiled egg doneness indicator system based on an Arduino Nano microcontroller using the Mamdani fuzzy logic method, with two input variables (temperature and boiling time) and one output variable representing egg doneness level on a scale of 0–100, governed by 12 fuzzy rules with centroid defuzzification. Calibration of the HC-SR04 sensor yielded the regression equation $y = 0.9841x + 0.2718$ with an average relative error of 1.33%, while calibration of the thermocouple sensor yielded $y = 1.0045x + 2.6448$ with an average relative error of 0.345%, both meeting instrumentation measurement reliability standards. System testing across 9 temperature-time combination scenarios produced fuzzy output values ranging from 19.47 to 91.64, and demonstrated that the system successfully classified egg doneness levels (raw, Half Boiled, Soft Boiled, and fully cooked) in all 9 out of 9 scenarios in accordance with the designed rule base.

Keywords: *Arduino Nano, boiled egg doneness indicator, centroid defuzzification, fuzzy logic Mamdani, temperature sensor, ultrasonic sensor*