DEVELOPMENT OF AN AUTOMATED-TURNING EGG INCUBATOR

BY

MICHAEL, FRIDAY ONORIODE (PG 18/0399)
PGD ELECTRICAL AND ELECTRONICS ENGINEERING (FUNAAB)

An M.Eng Dissertation Submitted to Department of Electrical And Electronics Engineering, College of Engineering Federal University of Agriculture, Abeokuta in Partial Fulfillment of the Requirement for the Award of Master Degree in Electrical and Electronics Engineering (Electrical Power Systems and Machines)

JUNE 2025

ABSTRACT

Globally, the demand for eggs and other poultry products in recent times as one of the major ources of protein is increasing rapidly. The conventional incubating systems (IS) usually mployed in the hatching of eggs involves manual turning of the egg tray, leading to inability o attain optimal temperature and humidity required for an efficient hatching production. Hence, the need for the development of an automated egg IS. This study developed a 30-egg apacity automated-turning incubator for efficient hatching. The system comprises six core egments including power supply (PS), microcontroller, egg turning (ET), sensing, display nd Internet of Things (IoT) units. The charging time of the 12 V, 40 Ah rechargeable lithium attery employed as the system's PS was determined using combined power and charge quations. The microcontroller unit was designed with ESP32 microcontroller, which has in-uilt internet facility and the 5 V required for its operation was obtained from PS unit using M7805 regulator. An integrated AM2302 (wired DHT22) sensor with capability to regulate oth temperature and relative humidity was employed for the sensing unit design. The ystem's humidity was determined using ideal gas and mass per volume equations while its mperature was evaluated using the heat equation. The ET unit was designed with National lectrical Manufacturers Association (NEMA) 17 stepper motor (SM). The motor's otational movement was determined using torque equation. The display unit designed using .06 m organic light emitting diodes was interfaced with the system's components. The lynk 2.0 platform was used for the IoT architecture. The PS, microcontroller, ET, sensing, isplay and IoT units were tested and the voltage and/or current from the units were etermined using multimeter and clamp meter. The performance of the incubator developed as also tested using thirty samples of fertilised eggs sourced from hatchery unit of Obasanjo arm Limited, Ota, Ogun-State to determine system's optimal humidity, temperature, atching period (HP) and hatching efficiency (HE). The results revealed that the measured oltage and current from the PS, ET and sensing units ranged from 5.0 to 14.1 V and 0.2 to

6.1 A while the measured voltage from microcontroller, display and IoT units, respectively, ranged from 3.0 to 5.0 V. The time taken for the system's battery to fully charge was determined as 1 hour. The SM turned the egg tray within angles of -30 to +30°. The system's optimum temperature and humidity were 38°C and 76%, respectively. The system's HPs were between 17 to 21 days while its HE was 90%. The system's responses to changes in temperature and humidity were received on the mobile phone via the Blynk application. These results were indications that the developed egg incubator operated according to the design specifications. The developed automated-turning incubator aided robust hatching of eggs for improved production.