



# A MOBILE INTELLIGENT POULTRY FEED DISPENSING SYSTEM USING PARTICLE SWARM OPTIMIZED PID CONTROL TECHNIQUE

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## ABSTRACT

Poultry farming in the tropics incurs a high cost on farmers due to the manual pattern of feeding. This in turn gives a low return on investment, low yield and low profit. These shortcomings of the manual pattern of feeding are as a result of contamination of the poultry feed, wastage of the feed, fatigue and stress involved with monitoring of the birds and administration of the feed. This study describes the development of a mobile intelligent poultry feed dispensing system using Particle Swarm Optimization (PSO) tuned Proportional Integral Derivative (PID) control technique. The system is capable of moving in a structured environment within a deep litter poultry farm and dispenses solid and liquid feed to poultry birds. The performance of the system was evaluated in terms of the system response using the Overshoot, Rise time and settling time as parameters. The result after successful testing and performance evaluation of the system showed that the system can be used by farmers to easily administer both solid and liquid feed to poultry birds with a high return on investment, high yield and profit. The developed mechatronic system can be adopted by farmers to reduce high level of human involvement in poultry feeding.

**Key words:** *PID controller, Particle Swarm Optimization, Microcontroller, Feed, Dispensing, Precision Farming*

## 1. BACKGROUND TO THE STUDY

Poultry farming is still carried out manually in the tropics at an exorbitant cost with low return on investment despite the benefits of Precision Farming to livestock management. Poultry is the rearing of a group of birds such as domestic chickens, geese, turkeys and guinea fowls for the primary purpose of egg and meat production (Olaniyi, Salami, Adewumi and Ajibola, 2014). The poultry industry contributes greatly to the development of the Nigerian economy as it serves as a major source of egg and meat which have a high nutritional value in the supply of protein. There are mainly four management systems employed in the rearing of poultry birds which are the Free Range system, Battery Cage system, Deep Litter system and Perchery houses (Afolami, Aladejebi and Okojie, 2013).

Particle Swarm Optimization (PSO) is a global optimization method developed by Kennedy and Eberhart in 1995. PSO was developed from swarm intelligence and primarily based on the behaviour of bird flocks and fish schools. The PSO algorithm emulates the behaviour of animal groups that have no leaders and hence will find food by random (Bai, 2010; Rini, Shamsuddin and Yuhaniz, 2011). The particles search for food and communicate with one another. While they are searching for food, there is always one particle that has better resource information about where the food source can be located. Hence, through the communication, the particles will eventually converge towards the food source (Hussien, Selamat, Daud and Abidin, 2014). The process of the PSO algorithm to find optimal solutions to problems follows the behaviour of these particles (Rini *et al.*, 2011). PSO has many advantages over other global optimization methods such as fast convergence, simplicity and the ability to drive nonlinear plants and high order systems (Jaafar, Mohamed, Jamian, Aras, Kassim and Sulaima, 2014).

A number of related works exists in the application of precision farming technique to poultry feed dispensing system in literature. In Arulogun *et al.*, (2010) a mobile intelligent poultry feed dispensing system was developed. The system was able to move, detect and avoid obstructions and dispense solid feed to poultry birds. But some of the limitations of this system were that it could not dispense liquid feed and the solid feed was not only unhygienically dispensed, dispensed was too large for the chicks to feed on. In Olaniyi *et al.*, (2014), a mobile intelligent poultry feed and water dispensing system was designed using fuzzy logic control technique. The system is capable of sensing the feed and water level and dispenses feed and water when the levels were low. But some of the limitations of this system were that it was not mobile and fuzzy logic is