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Towards The Development of a Mobile Intelligent Poultry Feed Dispensing System Using Particle Swarm Optimized PID Control Technique

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ABSTRACT

The manual pattern of feeding of poultry birds incurs an exorbitant cost on poultry farming. This pattern of feeding which is predominant in the tropics gives a low return on investment, low yield and low profit. These shortcomings 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. Hence, there is a need for a system which is capable of addressing these limitations. This study proposes the design of a mobile intelligent poultry feed dispensing system using Particle Swarm Optimized PID control technique. The system will be capable of moving from one point to another within a deep litter poultry house, as well as dispense both solid and liquid feed to poultry birds at specific time intervals. The system shall be intelligent with a Proportional-Integral-Derivative (PID) controller tuned with the Particle Swarm Optimization algorithm in order to increase the performance of the system. The successful development of the anticipated intelligent poultry feeding system is expected to reduce human intervention, increase yield and profit as well as provides high return on investment in poultry farming.

Keywords: PID Controller, Particle Swarm Optimization, Microcontroller, Precision Livestock Farming, Dispensing

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1. BACKGROUND TO THE STUDY

The application of the principle of process engineering to intensive and extensive livestock management is referred to as Precision Livestock Farming (PLF) [1]. In PLF, the potential of Information and Communication Technology (ICT) is utilized to assist farmers to automatically monitor animals onsite and remotely. This in turn improves production efficiency, increases animal and human welfare using appropriate hardware and necessary software techniques [2]. The application of PLF to poultry feeding has provided tremendous benefits from literature for improved production efficiency of chicken, geese, guinea fowls and most importantly, improved techniques of rearing of birds [3]. The poultry industry contributes immensely 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 [4]. In the free range system, birds are kept in an open space and fed manually. Some of the shortcomings of this method are missing of some birds and lot of human involvement [5]. In the Battery Cage system, the birds are kept in individual cage compartments in a large controlled environment [6]. The major challenge of this method is that it is very expensive to implement and there is a high risk of disease outbreak and cannibalism [7]. In the case of the Deep Litter system, the birds are kept in a building with leaves, saw dust, dry grasses or straw on the floor. The birds are allowed to move freely within the building. This method reduces the level of worm infection and provides protection for the birds against predators [5].

Poultry farmers in Nigeria encounter many problems such as contamination of the feed, wastage, high level of human involvement and stress of constant monitoring of the poultry birds. Some of these problems are tackled by increasing the work force on the farm or individually monitoring the birds but these are stressful and expensive to implement. Due to the limitations outlined, there is a need to develop an intelligent mobile system that will dispense both solid and liquid feed to the birds as well as control the amount of feed that is dispensed to poultry birds in poultry farms. A number of related works exists in literature. Authors in [8] designed and constructed a computer controlled poultry feed dispenser and temperature regulator. The system was made up of a dispenser which was capable of communicating with a computer via a parallel port. The system was also capable of dispensing feed at specific time intervals. But some of the limitations of the system were that it was not sensitive to obstructions, there was a high cost of maintenance and the system was affected by long distances due to the parallel port connection.