DEVELOPMENT AND TESTING OF FEEDER UNIT FOR PISTACHIO SORTING MACHINE

BY: M. ALI AKBARI, JANUARY 2009, 120 Pages

SUMMARY

In this research, a feeder unit for feeding pistachio nuts one by one to an acoustic pistachio sorter was designed, developed and evaluated. This mechanism includes a hopper, cellular conveyor belt and a brush to single pistachio nuts. Pistachio nuts after leaving the hopper and placement in cells of the conveyor belt, move toward the brush. The brush has an opposite direction of rotation to the conveyor belt and push aside extra pistachio nuts. Hence it permits only pistachio nuts that sitting in cells of conveyor belt to pass. The evaluation part of this research has two sections: feeder evaluation and sorter performance evaluation. Feeder evaluation has been done with a factorial experiment in a completely randomized design using 3 levels of conveyor belt speeds (30, 45 and 60 rpm), 3 levels of conveyor slope angles (0, 15 and 30 degree) and 2 levels of brush speeds (75 and 150 rpm). The measured factors were: number of empty cells in conveyor belt, number of cells containing two pistachio nuts and the position of pistachio nuts after dropping. The results showed that when the conveyor belt speed, slope angle and brush speed were 45 rpm, 0 degree and 150 rpm, respectively, the number of empty cell of conveyor belt was least and when they were 30 rpm, 30 degree and 150 rpm, respectively, the number of cells that containing two pistachio nuts were least and when they were 30 or 45 rpm, 15 degree and 150 rpm, respectively, number of pistachio nuts that fall out the sound generation unit were least. The sorter was evaluated using Ahmad Aghaie pistachio nut variety. After data collection by automatic feeder in 3 levels of dropping high (15, 25 and 35 cm) and using PCA method, 18 features were extracted for separating pistachio nut type. The optimal model was selected after several evaluation based on minimizing of mean square error (MSE), coefficient of correlation and correct separation rate. The optimal ANN model for this system had a 18-20-2 configuration. The total system accuracy for the pistachio split types (open-shell, closed-shell) were 96.67% and 91.67%, respectively.

Keywords: Feeder, Conveyor belt, Brush, Pistachio nut, Sorter, Neural network, Evaluation.

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